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TECHNICAL SPECIFICATION

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# Contents

# Foreword

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# 1 Scope

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

# 2 References

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

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


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

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

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

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

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

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

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

[8] 3GPP TS 38. 212 "NR; Multiplexing and channel coding".

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

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

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

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

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

**EN-DC**: E-UTRA-NR Dual Connectivity as defined in TS 37.340 [17, Section 4.1.2].

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

**FR1**: Frequency range 1 as defined in TS 38.104 [13, Section 5.1].

**FR2**: Frequency range 2 as defined in TS 38.104 [13, Section 5.1].

**gNB**: as defined in in TS 38.300 [10].

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

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

**NSA operation mode**: EN-DC operation mode, where the UE is configured at least with PSCell and E-UTRA PCell.

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

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

**SA operation mode**: Operation mode when the UE is configured with at least PCell.

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

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

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

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

**SSB:** SS/PBCH block as defined in TS 38.211 [6, section 7.8.3].

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

## 3.2 Symbols

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

| | |
|---|---|
| […] | Values included in square bracket must be considered for further studies, because it means that a decision about that value was not taken. |
| $T_c$ | Basic time unit, defined in TS 38.211 [6, Section 4.1]. |
| $T_s$ | Reference time unit, defined in TS 38.211 [6, Section 4.1]. |

## 3.3 Abbreviations

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

| | |
|---|---|
| BWP | Bandwidth Part |
| CA | Carrier Aggregation |
| CC | Component Carrier |
| CP | Cyclic Prefix |
| CSI | Channel-State Information |
| CSI-RS | CSI Reference Signal |
| DC | Dual Connectivity |
| DL | Downlink |
| DMRS | Demodulation Reference Signal |
| DRX | Discontinuous Reception |
| E-UTRA | Evolved UTRA |
| E-UTRAN | Evolved UTRAN |
| EN-DC | E-UTRA-NR Dual Connectivity |
| FDD | Frequency Division Duplex |
| FR | Frequency Range |
| HARQ | Hybrid Automatic Repeat Request |
| HO | Handover |
| MAC | Medium Access Control |
| MCG | Master Cell Group |
| MGL | Measurement Gap Length |
| MGRP | Measurement Gap Repetition Period |
| MIB | Master Information Block |
| NR | New Radio |
| NSA | Non-Standalone operation mode |
| OFDM | Orthogonal Frequency Division Multiplexing |
| OFDMA | Orthogonal Frequency Division Multiple Access |
| PBCH | Physical Broadcast Channel |
| PCell | Primary Cell |
| PLMN | Public Land Mobile Network |
| PRACH | Physical RACH |
| PSCell | Primary SCell |
| PSS | Primary Synchronization Signal |
| PUCCH | Physical Uplink Control Channel |
| PUSCH | Physical Uplink Shared Channel |
| RACH | Random Access Channel |
| RAT | Radio Access Technology |
| RLM | Radio Link Monitoring |
| RLM-RS | Reference Signal for RLM |
| RRC | Radio Resource Control |
| RRM | Radio Resource Management |
| RSSI | Received Signal Strength Indicator |
| SA | Standalone operation mode |
| SCell | Secondary Cell |
| SCG | Secondary Cell Group |
| SCS | Subcarrier Spacing |
| $SCS_{SSB}$ | SSB subcarrier spacing |

| | |
|---|---|
| SDL | Supplementary Downlink |
| SFN | System Frame Number |
| SI | System Information |
| SIB | System Information Block |
| SMTC | SSB-based Measurement Timing configuration |
| SRS | Sounding Reference Signal |
| SSSS-RSRP | Synchronization Signal based Reference Signal Received Power |
| SS-RSRQ | Synchronization Signal based Reference Signal Received Quality |
| SS-SINR | Synchronization Signal based Signal to Noise and Interference Ratio |
| SSB | Synchronization Signal Block |
| SSB_RP | Received (linear) average power of the resource elements that carry NR SSB signals and channels, measured at the UE antenna connector. |
| SSS | Secondary Synchronization Signal |
| SUL | Supplementary Uplink |
| TA | Timing Advance |
| TAG | Timing Advance Group |
| TDD | Time Division Duplex |
| TTI | Transmission Time Interval |
| UE | User Equipment |
| UL | Uplink |

## 3.4 Test tolerances

The requirements given in the present document make no allowance for measurement uncertainty. The test specification 38.5xx [x] defines the test tolerances.

*Editor's note: intended to capture test tolerances. OTA test tolerance or margin will be captured in this section if needed.*

## 3.5 Frequency bands grouping

### 3.5.1 Introduction

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

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

### 3.5.2 NR operating bands in FR1

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

**Table 3.5.2-1: NR frequency band groups for FR1**

| Group | NR FDD | | NR TDD | |
|---|---|---|---|---|
| | Band group notation | Operating bands | Band group notation | Operating bands |
| A | NR_FDD_FR1_A | n1, n70, n74[4] | NR_TDD_FR1_A | n34, n38, n39, n40, n50, n51 |
| B | NR_FDD_FR1_B | n66, n74[3] | NR_TDD_FR1_B | - |
| C | NR_FDD_FR1_C | - | NR_TDD_FR1_C | n77[1], n78, n79 |
| D | NR_FDD_FR1_D | n28 | NR_TDD_FR1_D | n77[2] |
| E | NR_FDD_FR1_E | n2, n5, n7 | NR_TDD_FR1_E | n41 |
| F | NR_FDD_FR1_F | - | NR_TDD_FR1_F | - |
| G | NR_FDD_FR1_G | n3, n8, n12, n20, n71 | NR_TDD_FR1_G | - |
| H | NR_FDD_FR1_H | n25 | NR_TDD_FR1_H | - |
| NOTE 1: Except 3.8 GHz to 4.2 GHz.<br>NOTE 2: Only 3.8 GHz to 4.2 GHz.<br>NOTE 3: Except 1475.9 MHz to 1510.9 MHz.<br>NOTE 4: Only when the band is confined in 1475.9 MHz to 1510.9 MHz. | | | | |

## 3.5.3 NR operating bands in FR2

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

**Table 3.5.3-1: NR frequency band groups for FR2**

| Group | Band group notation | Operating bands |
|---|---|---|
| A | NR_TDD_FR2_A | n257[1], n258[1], n261[1] |
| B | NR_TDD_FR2_B | n257[4], n258[4], n261[4] |
| C | NR_TDD_FR2_C | |
| D | NR_TDD_FR2_D | |
| E | NR_TDD_FR2_E | |
| F | NR_TDD_FR2_F | n260[4] |
| G | NR_TDD_FR2_G | n257[2], n258[2], n260[1], n261[2] |
| H | NR_TDD_FR2_H | |
| I | NR_TDD_FR2_I | |
| J | NR_TDD_FR2_J | |
| K | NR_TDD_FR2_K | |
| L | NR_TDD_FR2_L | |
| M | NR_TDD_FR2_M | |
| N | NR_TDD_FR2_N | |
| O | NR_TDD_FR2_O | |
| P | NR_TDD_FR2_P | |
| Q | NR_TDD_FR2_Q | |
| R | NR_TDD_FR2_R | |
| S | NR_TDD_FR2_S | |
| T | NR_TDD_FR2_T | n257[3], n258[3], n261[3] |
| U | NR_TDD_FR2_U | |
| V | NR_TDD_FR2_V | |
| W | NR_TDD_FR2_W | |
| X | NR_TDD_FR2_X | |
| Y | NR_TDD_FR2_Y | n260[3] |
| NOTE 1: UE power class 1.<br>NOTE 2: UE power class 2.<br>NOTE 3: UE power class 3.<br>NOTE 4: UE power class 4. | | |

# 3.6 Applicability of requirements in this specification version

In this specification,

- ‘cell’, ‘PCell’, ‘PSCell’ and ‘SCell’ refer to NR cell, NR PCell, NR PSCell and NR SCell,
- E-UTRA cells are referred to as ‘E-UTRA cell’, ‘E-UTRA PCell’ and ‘E-UTRA SCell’,

- E-UTRA-NR dual connectivity where E-UTRA is the master is referred to as 'E-UTRA-NR dual connectivity' or 'EN-DC'.

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

### 3.6.1 RRC connected state requirements in DRX

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

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

Otherwise the UE shall assume that DRX is used.

### 3.6.2 Number of serving carriers

#### 3.6.2.1 Number of serving carriers for SA

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

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

#### 3.6.2.2 Number of serving carriers for EN-DC

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

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

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

### 3.6.3 Applicability for SSB Rx beam in intra-band FR2

For the requirements in RRC connected state specified in this version of the specification, UE shall assume that the SSBs from the serving cells should have the same downlink spatial domain transmission filter in the same band in FR2. If the SSBs don't have same downlink spatial domain transmission filter the UE is not supposed to satisfy any requirements for SCell.

# 4 SA: RRC_IDLE state mobility

Editor's note: intended to capture the RRM requirements for RRC_IDLE state in stand-alone operation.

## 4.1 Cell Selection

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

## 4.2 Cell Re-selection

### 4.2.1 Introduction

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

When the UE is in either *Camped Normally* state or *Camped on Any Cell* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may not provide explicit neighbour list but carrier frequency information and bandwidth information only. UE measurement activity is also controlled by measurement rules defined in TS 38.304, allowing the UE to limit its measurement activity.

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

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

- for the UE capable of SUL, the applicable exceptions for side conditions are specified in Annex B, Section B.3.4.1 for UE supporting SUL in FR1.

### 4.2.2 Requirements

#### 4.2.2.1 UE measurement capability

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

- Intra-frequency carrier, and

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

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

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

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

#### 4.2.2.2 Measurement and evaluation of serving cell

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

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

otherwise M1=1.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least DRX cycle/2.

If the UE has evaluated according to Table 4.2.2.1-1 in $N_{serv}$ consecutive DRX cycles that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

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

**Table 4.2.2.1-1: $N_{serv}$**

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

## 4.2.2.3 Measurements of intra-frequency NR cells

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

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS38.304 within $T_{detect,NR\_Intra}$ when that Treselection= 0 . An intra frequency cell is considered to be detectable according to the conditions defined in Annex B.1.2 for a corresponding Band.

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

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

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

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

- when *rangeToBestCell* is not configured, the cell has at least [3]dB in FR1 or [TBD]dB in FR2 better ranked or
- when *rangeToBestCell* is configured, the cell which has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among the cells whose cell-ranking criterion R value as specified in TS 38.304 [1, Section 5.2.4.6] is within *rangeToBestCell* of the R value of the best cell where the best cell has at least [TBD] in FR1 or [TBD]dB in FR2 better ranked, and if there are multiple such cells the UE shall perform cell reselection to the highest ranked cell among them.

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

If $T_{reselection}$ timer has a non zero value and the intra-frequency cell is satisfied with the reselection criteria which are defined in TS38.304 [1], the UE shall evaluate this intra-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

**Table 4.2.2.3-1: $T_{detect,NR\_Intra}$, $T_{measure,NR\_Intra}$ and $T_{evaluate,NR\_Intra}$**

| DRX cycle length [s] | Scaling Factor (N1) | | $T_{detect,NR\_Intra}$ [s] (number of DRX cycles) | $T_{measure,NR\_Intra}$ [s] (number of DRX cycles) | $T_{evaluate,NR\_Intra}$ [s] (number of DRX cycles) |
|---|---|---|---|---|---|
| | FR1 | FR2[Note1] | | | |
| 0.32 | 1 | [8] | 11.52 x N1 x M2 (36 x N1 x M2) | 1.28 x N1 x M2 (4 x N1 x M2) | 5.12 x N1 x M2 (16 x N1 x M2) |
| 0.64 | | [5] | 17.92 x N1 (28 x N1) | 1.28 x N1 (2 x N1) | 5.12 x N1 (8 x N1) |
| 1.28 | | [4] | 32 x N1 (25 x N1) | 1.28 x N1 (1 x N1) | 6.4 x N1 (5 x N1) |
| 2.56 | | [TBD] | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| Note 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = [8] for all DRX cycle length.<br>Note 2: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. | | | | | |

### 4.2.2.4 Measurements of inter-frequency NR cells

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

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

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

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS38.304 within $K_{carrier}$ * $T_{detect,NR\_Inter}$ if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when $T_{reselection}$ = 0 provided that the reselection criteria is met by a margin of at least [5] dB in FR1 or [TBD]dB in FR2 for reselections based on ranking or [6]dB in FR1 or [TBD] dB in FR2 for SS-RSRP reselections based on absolute priorities or [4]dB in FR1 and [TBD] in FR2 for SS-RSRQ reselections based on absolute priorities. The parameter $K_{carrier}$ is the number of NR inter-frequency carriers indicated by the serving cell. An inter-frequency cell is considered to be detectable according to the conditions defined in Annex B.1.3 for a corresponding Band.

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

The UE shall measure SS-RSRP or SS-RSRQ at least every $K_{carrier}$ * $T_{measure,NR\_Inter}$ (see table 4.2.2.4-1) for identified lower or equal priority inter-frequency cells. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

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

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

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

- the condition when performing equal priority reselection and

  - when *rangeToBestCell* is not configured, the cell has at least [5]dB in FR1 or [TBD]dB in FR2 better ranked or

  - when *rangeToBestCell* is configured, the cell which has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among the cells whose cell-ranking criterion R value as specified in TS 38.304 [1, Section 5.2.4.6] is within *rangeToBestCell* of the R value of the best cell where the best cell has at least [TBD] in FR1 or [TBD]dB in FR2 better ranked, and if there are multiple such cells the UE shall perform cell reselection to the highest ranked cell among them or

- [6]dB in FR1 or [TBD]dB in FR2 for SS-RSRP reselections based on absolute priorities or

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

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

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

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

- $T_{SMTC\_intra} = T_{SMTC\_inter}$ = 160 ms; where $T_{SMTC\_intra}$ and $T_{SMTC\_inter}$ are periodicities of the SMTC occasions configured for the intra-frequency carrier and the inter-frequency carrier respectively,

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

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

**Table 4.2.2.4-1: $T_{detect,NR\_Inter}$, $T_{measure,NR\_Inter}$ and $T_{evaluate,NR\_Inter}$**

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

## 4.2.2.5 Measurements of inter-RAT E-UTRAN cells

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

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

The requirements in this section apply for inter-RAT E-UTRAN FDD measurements and E-UTRA TDD measurements. When the measurement rules indicate that inter-RAT E-UTRAN cells are to be measured, the UE shall measure RSRP and RSRQ of detected E-UTRA cells in the neighbour frequency list at the minimum measurement rate specified in this section. The parameter $N_{EUTRA\_carrier}$ is the total number of configured E-UTRA carriers in the neighbour frequency list. The UE shall filter RSRP and RSRQ measurements of each measured E-UTRA cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,EUTRAN}/2$.

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

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

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

The UE shall be able to evaluate whether a newly detectable inter-RAT E-UTRAN cell meets the reselection criteria defined in TS38.304 within ($N_{EUTRA\_carrier}$) * $T_{detect,EUTRAN}$ when Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ when $T_{reselection}$ = 0 provided that the reselection criteria is met by a margin of at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities.

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

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

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

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

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

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

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

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

### 4.2.2.6 Maximum interruption in paging reception

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

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

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

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

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

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

#### 4.2.2.7 General requirements

The UE shall search every layer of higher priority at least every $T_{higher\_priority\_search}$ = ([60] * $N_{layers}$) seconds, where $N_{layers}$ is the total number of higher priority NR and E-UTRA carrier frequencies broadcasted in system information.

# 5 SA: RRC_INACTIVE state mobility

## 5.1 Cell Re-selection

### 5.1.1 Introduction

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

When the UE is in *Camped Normally* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may not provide explicit neighbour list but carrier frequency information and bandwidth information only. UE measurement activity is also controlled by measurement rules defined in TS38.304, allowing the UE to limit its measurement activity.

### 5.1.2 Requirements

#### 5.1.2.1 UE measurement capability

The requirements in sub-clause 4.2.2.1 shall apply.

#### 5.1.2.2 Measurement and evaluation of serving cell

The requirements in sub-clause 4.2.2.2 shall apply.

#### 5.1.2.3 Measurements of intra-frequency NR cells

The requirements in sub-clause 4.2.2.3 shall apply.

#### 5.1.2.4 Measurements of inter-frequency NR cells

The requirements in sub-clause 4.2.2.4 shall apply.

#### 5.1.2.5 Measurements of inter-RAT E-UTRAN cells

The requirements in sub-clause 4.2.2.5 shall apply.

#### 5.1.2.6 Maximum interruption in paging reception

The requirements in sub-clause 4.2.2.6 shall apply.

#### 5.1.2.7 General requirements

The requirements in sub-clause 4.2.2.7 shall apply.

## 5.2 RRC_INACTIVE Mobility Control

Editor's note: intended to capture requirements which applies for the transition between INACTIVE and IDLE state. This section might be removed if unnecessary.

# 6 RRC_CONNECTED state mobility

## 6.1 Handover

*Editor's note: if handover requirements are differentiated by with beamforming and without beamforming, then two sets of requirements (with/without beamforming) could be specified in this section.*

### 6.1.1 NR Handover

#### 6.1.1.1 Introduction

#### 6.1.1.2 NR FR1 - NR FR1 Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR FR1 cell to NR FR1 cell.

##### 6.1.1.2.1 Handover delay

Procedure delays for all procedures that can command a handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ seconds from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the maximum RRC procedure delay to be defined in clause12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.1.2.2.

##### 6.1.1.2.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + 20 + T_{\Delta} \text{ ms}$$

Where:

$T_{search}$ is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then $T_{search}$ = 0 ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot ≥ -TBD dB, then $T_{search} = T_{rs} + 2$ ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot ≥ -TBD dB, then $T_{search}$ = [3* $T_{rs}$ + 2] ms. Regardless of whether DRX is in use by the UE, $T_{search}$ shall still be based on non-DRX target cell search times.

$T_{\Delta}$ is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = T_{rs}$.

$T_{IU}$ is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. $T_{IU}$ can be up to x*10 +10 ms. x is defined in the table 6.3.3.2-2 of TS 38.211 [6].

$T_{rs}$ is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cellin the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this section is applied with Trs = [5] ms assuming the SSB transmission periodicity is 5 ms. There is no requirements if the SSB transmission periodicity is not 5 ms.

NOTE 1: The actual value of $T_{IU}$ shall depend upon the PRACH configuration used in the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 9.2.5 for intra-frequency handover and Clause 9.3.1 for inter-frequency handover.

#### 6.1.1.3 NR FR2- NR FR1 Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR2 cell to NR FR1 cell.

##### 6.1.1.3.1 Handover delay

Procedure delays for all procedures that can command a handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ seconds from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the maximum RRC procedure delay to be defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.1.3.2.

##### 6.1.1.3.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + 40 + T_{\Delta} \text{ ms}$$

Where:

$T_{search}$ is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then $T_{search}$ = 0 ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot ≥ -TBD dB, then $T_{search}$ = [3* $T_{rs}$ + 2] ms. Regardless of whether DRX is in use by the UE, $T_{search}$ shall still be based on non-DRX target cell search times.

$T_{\Delta}$ is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = T_{rs}$.

$T_{IU}$ is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. $T_{IU}$ can be up to x*10 +10 ms. x is defined in the table 6.3.3.2-2 of [6].

$T_{rs}$ is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this section is applied with Trs = [5] ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5ms. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2* prior to the handover command, $T_{rs}$ follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

NOTE 1: The actual value of $T_{IU}$ shall depend upon the PRACH configuration used in the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 9.2.5 for intra-frequency handover and Clause 9.3.1 for inter-frequency handover.

#### 6.1.1.4 NR FR2- NR FR2 Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR FR2 cell to NR FR2 cell.

##### 6.1.1.4.1 Handover delay

Procedure delays for all procedures that can command a handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ seconds from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the maximum RRC procedure delay to be defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.1.4.2.

#### 6.1.1.4.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} \text{ ms}$$

Where:

$T_{search}$ is the time required to search the target cell when the handover command is received by the UE. If the target cell is an intra-frequency cell and the target cell Es/Iot $\geq$ -TBD dB, then $T_{search}$ = [8* $T_{rs}$ + 2] ms. If the target cell is an inter-frequency cell and the target cell Es/Iot $\geq$ -TBD dB, then $T_{search}$ = [8*3* $T_{rs}$ + 2] ms. Regardless of whether DRX is in use by the UE, $T_{search}$ shall still be based on non-DRX target cell search times.

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20ms.

$T_{\Delta}$ is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta}$ = [1]* $T_{rs}$.

$T_{IU}$ is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. $T_{IU}$ can be up to x*10 +10 ms. x is defined in the table 6.3.3.2-2 of [6].

$T_{rs}$ is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this section is applied with Trs = [5] ms assuming the SSB transmission periodicity is 5 ms. There is no requirements if the SSB transmission periodicity is not 5 ms. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2* prior to the handover command, $T_{rs}$ follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

NOTE 1: The actual value of $T_{IU}$ shall depend upon the PRACH configuration used in the target cell.

NOTE 2: Void

### 6.1.1.5 NR FR1- NR FR2 Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR1 cell to NR FR2 cell.

#### 6.1.1.5.1 Handover delay

Procedure delays for all procedures that can command a handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ seconds from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the maximum RRC procedure delay to be defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.1.5.2.

#### 6.1.1.5.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} \text{ ms}$$

Where:

$T_{search}$ is the time required to search the target cell when the handover command is received by the UE. If the target cell is an intra-frequency cell and the target cell Es/Iot $\geq$ -TBD dB, then $T_{search}$ = [8* $T_{rs}$ + 2] ms. If the target cell is an inter-frequency cell and the target cell Es/Iot ≥ -TBD dB,, then $T_{search}$ = [8*3* $T_{rs}$ + 2] ms. Regardless of whether DRX is in use by the UE, $T_{search}$ shall still be based on non-DRX target cell search times.

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up 40ms.

$T_{\Delta}$ is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta}$ = [1]* $T_{rs}$.

$T_{IU}$ is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. $T_{IU}$ can be up to x*10 +10 ms. x is defined in the table 6.3.3.2-2 of [6].

$T_{rs}$ is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this section is applied with Trs=[5] ms assuming the SSB transmission periodicity is 5 ms. There is no requirements if the SSB transmission periodicity is not 5 ms. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2* prior to the handover command, $T_{rs}$ follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

NOTE 1: The actual value of $T_{IU}$ shall depend upon the PRACH configuration used in the target cell.

NOTE 2: Void

## 6.1.2 NR Handover to other RATs

### 6.1.2.1 NR – E-UTRAN Handover

#### 6.1.2.1.1 Introduction

The purpose of inter-RAT handover from NR to E-UTRAN is to change the radio access mode from NR to E-UTRAN. The handover procedure is initiated from NR with a RRC message that implies a handover as described in TS 38.331 [2].

#### 6.1.2.1.2 Handover delay

When the UE receives a RRC message implying handover to E-UTRAN the UE shall be ready to start the transmission of the uplink PRACH channel in E-UTRA within $D_{handover}$ seconds from the end of the last TTI containing the RRC command. $D_{handover}$ is defined as

$$D_{handover} = T_{RRC\_procedure\_delay} + T_{interruption}$$

Where:

$T_{RRC\_procedure\_delay}$: it is the RRC procedure delay, which is 50ms

$T_{interruption}$: it is the time between end of the last TTI containing the RRC command on the NR PDSCH and the time the UE starts transmission of the PRACH in E-UTRAN, excluding $T_{RRC\_procedure\_delay}$. $T_{interruption}$ is defined in clause 6.1.1.3.

#### 6.1.2.1.3 Interruption time

When the inter-RAT handover to E-UTRAN is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + 20 \text{ ms}$$

Where:

$T_{search}$ is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then $T_{search}$ = 0 ms. If the target cell is unknown and signal quality is sufficient for successful cell detection on the first attempt, then $T_{search}$ = 80 ms. Regardless of whether DRX is in use by the UE, $T_{search}$ shall still be based on non-DRX target cell search times.

$T_{IU}$ is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. $T_{IU}$ can be up to 30 ms.

NOTE: The actual value of $T_{IU}$ shall depend upon the PRACH configuration used in the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant E-UTRAN cell identification requirements are described in clause [9.4.1].

# 6.2 RRC Connection Mobility Control

## 6.2.1 SA: RRC Re-establishment

### 6.2.1.1 Introduction

This clause contains requirements on the UE regarding RRC connection re-establishment procedure. RRC connection re-establishment is initiated when a UE in RRC_CONNECTED state loses RRC connection due to any of failure cases, including radio link failure, handover failure, and RRC connection reconfiguration failure. The RRC connection re-establishment procedure is specified in clause 5.3.7 of TS 38.331 [2].

The requirements in this clause are applicable for RRC connection re-establishment to NR cell.

### 6.2.1.2 Requirements

In RRC connected mode the UE shall be capable of sending *RRCReestablishmentRequest* message within $T_{re\text{-}establish\_delay}$ seconds from the moment it detects a loss in RRC connection. The total RRC connection delay ($T_{re\text{-}establish\_delay}$) shall be less than:

$T_{UL\_grant}$: It is the time required to acquire and process uplink grant from the target PCell. The uplink grant is required to transmit *RRCReestablishmentRequest* message.

The UE re-establishment delay ($T_{UE\_re\text{-}establish\_delay}$) is specified in clause 6.2.1.2.1.

#### 6.2.1.2.1 UE Re-establishment delay requirement

The UE re-establishment delay ($T_{UE\_re\text{-}establish\_delay}$) is the time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 38.331 [2] is detected by the UE and when the UE sends PRACH to the target PCell. The UE re-establishment delay ($T_{UE\_re\text{-}establish\_delay}$) requirement shall be less than:

The intra-frequency target NR cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in Section 10.1.2 and 10.1.3 are fulfilled for a corresponding NR Band for FR1 and FR2, respectively,

- SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding NR Band.

The inter-frequency target NR cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in Section 10.1.4 and 10.1.5 are fulfilled for a corresponding NR Band for FR1 and FR2, respectively,

- SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding NR Band.

$T_{identify\_intra\_NR}$: It is the time to identify the target intra-frequency NR cell and it depends on whether the target NR cell is known cell or unknown cell and on the frequency range (FR) of the target NR cell. If the UE is not configured with intra-frequency NR carrier for RRC re-establishment then $T_{identify\_intra\_NR}$=0; otherwise $T_{identify\_intra\_NR}$ shall not exceed the values defined in table 6.2.1.2.1-1.

$T_{identify\_inter\_NR,i}$: It is the time to identify the target inter-frequency NR cell on inter-frequency carrier *i* configured for RRC re-establishment and it depends on whether the target NR cell is known cell or unknown cell and on the frequency range (FR) of the target NR cell. $T_{identify\_inter\_NR,i}$ shall not exceed the values defined in table 6.2.1.2.1-2.

$T_{SMTC}$: It is the periodicity of the SMTC occasion configured for the intra-frequency carrier. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2* prior to the handover command, $T_{smtc}$ follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.$T_{SMTC,i}$: It is the periodicity of the SMTC occasion configured for the inter-frequency carrier *i*.

$T_{SI-NR}$ = It is the time required for receiving all the relevant system information according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 38.331 [2] for the target PCell.

$T_{PRACH}$ = It is the delay caused due to the random access procedure when sending random access to the target NR cell. The delay depends on the PRACH configuration defined in Table 6.3.3.2-2 [6] or Table 6.3.3.2-3 [6] for FR1 and in Table 6.3.3.2-4 [6] for FR2.

$N_{freq}$: It is the total number of NR frequencies to be monitored for RRC re-establishment; $N_{freq}$ = 2 if the target inter-frequency PCell is known.

There is no requirement if the target cell does not contain the UE context.

In the requirement defined in the below tables, the target FR1 cell is known if it has been meeting the relevant cell identification requirement during the last [5] seconds otherwise it is unknown..

**Table 6.2.1.2.1-1: Time to identify target NR cell for RRC connection re-establishment to NR intra-frequency cell**

| Serving cell SSB Ês/Iot (dB) | Frequency range (FR) of target NR cell | $T_{identify\_intra\_NR}$ [ms] | |
|---|---|---|---|
| | | Known NR cell | Unknown NR cell |
| ≥ [-8] | FR1 | MAX (200 ms, [5] x $T_{SMTC}$) | MAX (800 ms, [10] x $T_{SMTC}$) |
| ≥ [-8] | FR2 | N/A | MAX (1000 ms, [80] x $T_{SMTC}$)) |
| < [-8] | FR1 | N/A | 800[Note1] |
| < [-8] | FR2 | N/A | 3420[Note1] |
| Note 1: $T_{SMTC}$ =20 ms when serving cell SSB Ês/Iot < [-8] dB | | | |

**Table 6.2.1.2.1-2: Time to identify target NR cell for RRC connection re-establishment to NR inter-frequency cell**

| Serving cell SSB Ês/Iot (dB) | Frequency range (FR) of target NR cell | $T_{identify\_inter\_NR,\ i}$ [ms] | |
|---|---|---|---|
| | | Known NR cell | Unknown NR cell |
| ≥ [-8] | FR1 | MAX (200 ms, [6] x $T_{SMTC,\ i}$) | MAX (800 ms, [13] x $T_{SMTC,\ i}$) |
| ≥ [-8] | FR2 | N/A | MAX (1000 ms, [104] x $T_{SMTC,\ i}$)) |
| < [-8] | FR1 | N/A | 800[Note1] |
| < [-8] | FR2 | N/A | 4000[Note1] |
| Note 1: $T_{SMTC,i}$ =20 ms when serving cell SSB Ês/Iot < [-8] dB | | | |

## 6.2.2 Random access

### 6.2.2.1 Introduction

This clause contains requirements on the UE regarding random access procedure. The random access procedure is initiated to establish uplink time synchronization for a UE which either has not acquired or has lost its uplink synchronization, or to convey UE's request Other SI, or for beam failure recovery. The random access is specified in clause 8 of TS 38.213 [3] and the control of the RACH transmission is specified in clause 5.1 of TS 38.321 [7].

### 6.2.2.2 Requirements

The UE shall have capability to calculate PRACH transmission power according to the PRACH power formula defined in TS 38.213 [3] and apply this power level at the first preamble or additional preambles. The absolute power applied to the first preamble shall have an accuracy as specified in Table 6.3.4.2-1 of TS 38.101-1 [18] for frequency range 1 and in Table 6.3.4.2-1 of TS 38.101-2 [19] for frequency range 2. The relative power applied to additional preambles shall have an accuracy as specified in Table 6.3.4.3-1 of TS 38.101-1 [18] for frequency range 1 and clause 6.3.4.3 of TS38.101-2 [19] for frequency range 2.

The UE shall indicate a Random Access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in clause 5.1.4 in TS 38.321 [7].

#### 6.2.2.2.1 Contention based random access

##### 6.2.2.2.1.1 Correct behaviour when transmitting Random Access Preamble

With the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall have the capability to select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB if the association between Random Access Preambles and SS blocks is configured, as specified in clause 5.1.2 in TS 38.321 [7].

With the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall have the capability to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, if the association between PRACH occasions and SSBs is configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

##### 6.2.2.2.1.2 Correct behaviour when receiving Random Access Response

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

##### 6.2.2.2.1.3 Correct behaviour when not receiving Random Access Response

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window defined in clause 5.1.4 in TS 38.321 [7].

##### 6.2.2.2.1.4 Correct behaviour when receiving a NACK on msg3

The UE shall re-transmit the msg3 upon the reception of a NACK on msg3.

##### 6.2.2.2.1.5 Correct behaviour when receiving a message over Temporary C-RNTI

The UE shall send ACK if the Contention Resolution is successful.

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

##### 6.2.2.2.1.6 Correct behaviour when contention Resolution timer expires

The UE shall re-select a preamble and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

#### 6.2.2.2.2 Non-Contention based random access

##### 6.2.2.2.2.1 Correct behaviour when transmitting Random Access Preamble

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs is configured, with the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs is configured, with the UE selected CSI-RS with CSI-RSRP above *cfra-csirs-DedicatedRACH-Threshold* amongst the associated CSI-RSs, UE shall have the capability to select the Random Access Preamble corresponding to the selected CSI-RS, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions in *ra-OccasionList* corresponding to the selected CSI-RS, and PRACH occasion shall be randomly selected with equal probability amongst the selected CSI-RS associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If the random access procedure is initialized for beam failure recovery and if the contention-free Random Access Resources and the contention-free PRACH occasions for beam failure recovery request associated with any of the SSBs and/or CSI-RSs is configured, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs or the selected CSI-RS with CSI-RSRP above *cfra-csirs-DedicatedRACH-Threshold* amongst the associated CSI-RSs, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, or from the PRACH occasions in *ra-OccasionList* corresponding to the selected CSI-RS, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB assocated PRACH occasions or the selected CSI-RS associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

###### 6.2.2.2.2.2 Correct behaviour when receiving Random Access Response

The UE may stop monitoring for Random Access Response(s), if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble, unless the random access procedure is initialized for Other SI request from UE.

The UE may stop monitoring for Random Access Response(s) and shall monitor the Other SI transmission if the Random Access Response only contains a Random Access Preamble identifier which is corresponding to the transmitted Random Access Preamble and the random access procedure is initialized for SI request from UE, as specified in clause 5.1.4 in TS 38.321 [7].

The UE may stop monitoring for Random Access Response(s), if the contention-free Random Access Preamble for beam failure recovery request was transmitted and if the PDCCH addressed to UE's C-RNTI is received, as specified in clause 5.1.4 in TS 38.321 [7].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamble with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

###### 6.2.2.2.2.3 Correct behaviour when not receiving Random Access Response

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamble with the calculated PRACH transmission power, if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon* or if no PDCCH addressed to UE's C-RNTI is received within the RA Response window configured in *BeamFailureRecoveryConfig*, as defined in clause 5.1.4 in TS 38.321 [7].

##### 6.2.2.2.3 UE behaviour when configured with supplementary UL

In addition to the requirements defined in clause 6.2.2.2.1 and 6.2.2.2.2, a UE configured with supplementary UL carrier shall use RACH configuration for the supplementary UL carrier contained in RMSI and RRC dedicated signalling. If the cell for the random access procedure is configured with supplementary UL, the UE shall transmit or re-transmit PRACH preamble on the supplementary UL carrier if the SS-RSRP measured by the UE on the DL carrier is lower than the *rsrp-ThresholdSSB-SUL* as defined in TS 38.331 [2].

## 6.2.3 SA: RRC Connection Release with Redirection

### 6.2.3.1 Introduction

This clause contains requirements on the UE regarding RRC connection release with redirection procedure. RRC connection release with redirection is initiated by the *RRCConnectionRelease* message with redirection to E-UTRAN or NR from NR specified in TS 38.331 [2]. The RRC connection release with redirection procedure is specified in clause 5.3.8 of TS 38.331 [2].

### 6.2.3.2 Requirements

#### 6.2.3.2.1 RRC connection release with redirection to NR

The UE shall be capable of performing the RRC connection release with redirection to the target NR cell within $T_{connection\_release\_redirect\_NR}$.

The time delay ($T_{connection\_release\_redirect\_NR}$) is the time between the end of the last slot containing the RRC command, "*RRCRelease*" (TS 38.331 [2]) on the NR PDSCH and the time the UE starts to send random access to the target NR cell. The time delay ($T_{connection\_release\_redirect\_NR}$) shall be less than:

$$T_{connection\_release\_redirect\_NR} = T_{RRC\_procedure\_delay} + T_{identify\text{-}NR} + T_{SI\text{-}NR} + T_{RACH}$$

The intra-frequency target NR cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in Section 10.1.2 and 10.1.3 are fulfilled for a corresponding NR Band for FR1 and FR2, respectively,
- SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding NR Band.

The inter-frequency target NR cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in Section 10.1.4 and 10.1.5 are fulfilled for a corresponding NR Band for FR1 and FR2, respectively,
- SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding NR Band.

$T_{RRC\_procedure\_delay}$: It is the RRC procedure delay for processing the received message "*RRCRelease*" as defined in clause 6.2.2 of TS 38.331 [2].

$T_{identify\text{-}NR}$: It is the time to identify the target NR cell and depend on the frequency range (FR) of the target NR cell. It is defined in table 6.2.3.2.1-1. Note that $T_{identify\text{-}NR} = T_{PSS/SSS\text{-}sync} + T_{meas}$, in which $T_{PSS/SSS\text{-}sync}$ is the cell search time and $T_{meas}$ is the measurement time due to cell selection criteria evaluation.

$T_{SI\text{-}NR}$: It is the time required for acquiring all the relevant system information of the target NR cell. This time depends upon whether the UE is provided with the relevant system information of the target NR cell or not by the old NR cell before the RRC connection is released. $T_{SI\text{-}NR} = 0$ provided the UE is provided with the SI (including MIB and all relevant SIBs) of the target NR cell before the RRC connection is released by the old NR cell.

$T_{RACH}$: It is the delay caused due to the random access procedure when sending random access to the target NR cell. This delay depends on the PRACH configuration defined in Table 6.3.3.2-2 [6] or Table 6.3.3.2-3 [6] for FR1 and in Table 6.3.3.2-4 [6] for FR2.

**Table 6.2.3.2.1-1: Time to identify target NR cell for RRC connection release with redirection to NR**

| Frequency range (FR) of target NR cell | $T_{identify\text{-}NR}$ |
|---|---|
| FR1 | MAX (680 ms, [11] x SMTC period) |
| FR2 | MAX (880 ms, 8x[11] x SMTC period) |
| Note : If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2* prior to the redirection command, SMTC follows *smtc1* or *smtc2* according to the physical cell ID of the target cell. | |

#### 6.2.3.2.2 RRC connection release with redirection to E-UTRAN

The UE shall be capable of performing the RRC connection release with redirection to the target E-UTRAN cell within $T_{connection\_release\_redirect\_E\text{-}UTRA}$.

The time delay ($T_{connection\_release\_redirect\_E\text{-}UTRA}$) is the time between the end of the last slot containing the RRC command, "*RRCRelease*" (TS 38.331 [2]) on the PDSCH and the time the UE starts to send random access to the target E-UTRA cell. The time delay ($T_{connection\_release\_redirect\_E\text{-}UTRA}$) shall be less than:

$$T_{connection\_release\_redirect\_E\text{-}UTRA} = T_{RRC\_procedure\_delay} + T_{identify\text{-}E\text{-}UTRA} + T_{SI\text{-}E\text{-}UTRA} + T_{RACH}$$

The target E-UTRA FDD or TDD cell shall be considered detectable when for each relevant SSB:

- RSRP related conditions in the accuracy requirements in Section 10.2.2 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2 and Annex B.3 of TS 36.133 [15],

- RSRQ related conditions in the accuracy requirements in Section 10.2.3 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2 and Annex B.3 of TS 36.133 [15],

- RS-SINR related conditions in the accuracy requirements in Section 10.2.5 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2 and Annex B.3 of TS 36.133 [15].

$T_{RRC\_procedure\_delay}$: It is the RRC procedure delay for processing the received message "*RRCRelease*" as defined in clause 6.2.2 of TS 38.331 [2].

$T_{identify\text{-}E\text{-}UTRA}$: It is the time to identify the target E-UTRA cell. It shall be less than 320 ms.

$T_{SI\text{-}E\text{-}UTRA}$: It is the time required for acquiring all the relevant system information of the target E-UTRA cell. This time depends upon whether the UE is provided with the relevant system information (SI) of the target E-UTRA cell or not by the old NR cell before the RRC connection is released. $T_{SI\text{-}E\text{-}UTRA} = 0$ provided the UE is provided with the SI (including MIB and all relevant SIBs) of the target E-UTRA cell before the RRC connection is released by the old NR cell.

$T_{RACH}$: It is the delay caused due to the random access procedure when sending random access to the target E-UTRA cell.

# 7 Timing

## 7.1 UE transmit timing

### 7.1.1 Introduction

The UE shall have capability to follow the frame timing change of the connected gNB. The uplink frame transmission takes place $(N_{\mathrm{TA}} + N_{\mathrm{TA\ offset}}) \times T_{\mathrm{c}}$ before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. The reference cell is PSCell in case of EN-DC. The reference cell is PCell in case of NR standalone. If the UE is configured with a pTAG containing the PCell, UE shall use the PCell as the reference cell for deriving the UE transmit timing for cells in the pTAG. If the UE is configured with a psTAG containing the PSCell, UE shall use the PSCell as the reference cell for deriving the UE transmit timing for cells in the psTAG.UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are defined in the following requirements.

### 7.1.2 Requirements

The UE initial transmission timing error shall be less than or equal to $\pm T_e$ where the timing error limit value $T_e$ is specified in Table 7.1.2-1. This requirement applies:

- when it is the first transmission in a DRX cycle for PUCCH, PUSCH and SRS or it is the PRACH transmission.

The UE shall meet the Te requirement for an initial transmission provided that at least one SSB is available at the UE during the last 160 ms. The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus $(N_{\mathrm{TA}} + N_{\mathrm{TA\ offset}}) \times T_{\mathrm{c}}$. The downlink timing is defined as the time when the first detected path (in time) of the corresponding downlink frame is received from the reference cell. $N_{\mathrm{TA}}$ for PRACH is defined as 0.

$(N_{\mathrm{TA}} + N_{\mathrm{TA\ offset}}) \times T_{\mathrm{c}}$ (in $T_c$ units) for other channels is the difference between UE transmission timing and the downlink timing immediately after when the last timing advance in clause 7.3 was applied. $N_{\mathrm{TA}}$ for other channels is not changed until next timing advance is received. The value of $N_{\mathrm{TA\ offset}}$ depends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). $N_{\mathrm{TA\ offset}}$ is defined in Table 7.1.2-2.

**Table 7.1.2-1: $T_e$ Timing Error Limit**

| Frequency Range | SCS of SSB signals (KHz) | SCS of uplink signals s(KHz) | $T_e$ |
|---|---|---|---|
| 1 | 15 | 15 | 12*64*$T_c$ |
| | | 30 | 10*64*$T_c$ |
| | | 60 | 10*64*$T_c$ |
| | 30 | 15 | 8*64*$T_c$ |
| | | 30 | 8*64*$T_c$ |
| | | 60 | 7*64*$T_c$ |
| 2 | 120 | 60 | 3.5*64*$T_c$ |
| | | 120 | 3.5*64*$T_c$ |
| | 240 | 60 | 3*64*$T_c$ |
| | | 120 | 3*64*$T_c$ |
| Note 1: $T_c$ is the basic timing unit defined in TS 38.211 [6] | | | |

**Table 7.1.2-2: The Value of $N_{\text{TA offset}}$**

| Frequency range and band of cell used for uplink transmission | $N_{\text{TA offset}}$ (Unit: $T_C$) |
|---|---|
| FR1 FDD band without LTE-NR coexistence case or FR1 TDD band without LTE-NR coexistence case | 25600 (Note 1) |
| FR1 FDD band with LTE-NR coexistence case | 0 (Note 1) |
| FR1 TDD band with LTE-NR coexistence case | 39936 (Note 1) |
| FR2 | 13792 |
| Note 1: The UE identifies $N_{\text{TA offset}}$ based on the information n-TimingAdvanceOffset according to [2]. If UE is not provided with the information n-TimingAdvanceOffset, the default value of $N_{\text{TA offset}}$ is set as 25600 for FR1 band. In case of multiple UL carriers in the same TAG, UE expects that the same value of n-TimingAdvanceOffset is provided for all the UL carriers according to section 4.2 in [3] and the value 39936 of $N_{\text{TA offset}}$ can also be provided for a FDD serving cell.Note 2: Void | |

When it is not the first transmission in a DRX cycle or there is no DRX cycle, and when it is the transmission for PUCCH, PUSCH and SRS transmission, the UE shall be capable of changing the transmission timing according to the received downlink frame of the reference cell except when the timing advance in clause 7.3 is applied.

When the transmission timing error between the UE and the reference timing exceeds $\pm T_e$, the UE is required to adjust its timing to within $\pm T_e$. The reference timing shall be $(N_{\text{TA}} + N_{\text{TA offset}}) \times T_c$ before the downlink timing of the reference cell. All adjustments made to the UE uplink timing shall follow these rules:

1) The maximum amount of the magnitude of the timing change in one adjustment shall be $T_q$.

2) The minimum aggregate adjustment rate shall be $T_p$ per second.

3) The maximum aggregate adjustment rate shall be $T_q$ per 200ms.

where the maximum autonomous time adjustment step $T_q$ and the aggregate adjustment rate $T_p$ are specified in Table 7.1.2-3.

**Table 7.1.2-3: $T_q$ Maximum Autonomous Time Adjustment Step and $T_p$ Minimum Aggregate Adjustment rate**

| Frequency Range | SCS of uplink signals (KHz) | $T_q$ | $T_p$ |
|---|---|---|---|
| 1 | 15 | 5.5*64*$T_c$ | 5.5*64*$T_c$ |
| | 30 | 5.5*64*$T_c$ | 5.5*64*$T_c$ |
| | 60 | 5.5*64*$T_c$ | 5.5*64*$T_c$ |
| 2 | 60 | 2.5*64*$T_c$ | 2.5*64*$T_c$ |
| | 120 | 2.5*64*$T_c$ | 2.5*64*$T_c$ |
| NOTE 1: $T_c$ is the basic timing unit defined in TS 38.211 [6] | | | |

# 7.2 UE timer accuracy

## 7.2.1 Introduction

UE timers are used in different protocol entities to control the UE behaviour.

## 7.2.2 Requirements

For UE timers specified in TS 38.331 [TBD], the UE shall comply with the timer accuracies according to Table 7.2.2-1.

The requirements are only related to the actual timing measurements internally in the UE. They do not include the following:

- Inaccuracy in the start and stop conditions of a timer (e.g. UE reaction time to detect that start and stop conditions of a timer is fulfilled), or

- Inaccuracies due to restrictions in observability of start and stop conditions of a UE timer (e.g. slot alignment when UE sends messages at timer expiry).

**Table 7.2.2-1**

| Timer value [s] | Accuracy |
|---|---|
| timer value < 4 | ± 0.1s |
| timer value ≥ 4 | ± 2.5% |

# 7.3 Timing advance

## 7.3.1 Introduction

The timing advance is initiated from gNB with MAC message that implies and adjustment of the timing advance, as defined in clause 5.2 of TS 38.321 [7].

## 7.3.2 Requirements

### 7.3.2.1 Timing Advance adjustment delay

UE shall adjust the timing of its uplink transmission timing at time slot $n+k$ for a timing advance command received in time slot $n$, and the value of $k$ is defined in section 4.2 in TS 38.213 [3]. The same requirement applies also when the UE is not able to transmit a configured uplink transmission due to the channel assessment procedure.

### 7.3.2.2 Timing Advance adjustment accuracy

The UE shall adjust the timing of its transmissions with a relative accuracy better than or equal to the UE Timing Advance adjustment accuracy requirement in Table 7.3.2.2-1, to the signalled timing advance value compared to the timing of preceding uplink transmission. The timing advance command step is defined in TS 38.213 [3].

**Table 7.3.2.2-1: UE Timing Advance adjustment accuracy**

| Sub Carrier Spacing, SCS kHz | 15 | 30 | 60 | 120 |
|---|---|---|---|---|
| UE Timing Advance adjustment accuracy | $\pm 256\ T_c$ | $\pm 256\ T_c$ | $\pm 128\ T_c$ | $\pm 32\ T_c$ |

# 7.4 Cell phase synchronization accuracy

## 7.4.1 Definition

Cell phase synchronization accuracy for TDD is defined as the maximum absolute deviation in frame start timing between any pair of cells on the same frequency that have overlapping coverage areas.

## 7.4.2 Minimum requirements

The cell phase synchronization accuracy measured at BS antenna connectors shall be better than 3 µs.

# 7.5 Maximum Transmission Timing Difference

## 7.5.1 Introduction

A UE shall be capable of handling a relative transmission timing difference between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell to be aggregated for EN-DC operation.

A UE shall be capable of handling a relative transmission timing difference among slot timing boundaries of different carriers to be aggregated in NR carrier aggregation.

### 7.5.2 Minimum Requirements for inter-band EN-DC

The UE shall be capable of handling a maximum uplink transmission timing difference between E-UTRA PCell and PSCell as shown in Table 7.5.2-1.

**Table 7.5.2-1 Maximum uplink transmission timing difference requirement for asynchronous EN-DC**

| Sub-carrier spacing in E-UTRA PCell (kHz) | UL Sub-carrier spacing for data in PSCell (kHz) | Maximum uplink transmission timing difference (µs) |
|---|---|---|
| 15 | 15 | 500 |
| 15 | 30 | 250 |
| 15 | 60 | 125 |
| 15 | 120[Note1] | 62.5 |
| NOTE 1: For E-UTRA FDD-NR FDD and E-UTRA TDD-NR TDD intra-band EN-DC, for which the requirement is defined in Section 7.5.3 and this Table 7.5.2-1 is also applicable, the scenario with 120kHz PSCell does not exist. | | |

The UE shall be capable of handling a maximum uplink transmission timing difference between E-UTRA PCell and PSCell as shown in Table 7.5.2-2. The requirements for synchronous EN-DC are applicable for E-UTRA TDD-NR TDD, E-UTRA FDD-NR FDD, E-UTRA TDD-NR FDD and E-UTRA FDD-NR TDD inter-band EN-DC.

**Table 7.5.2-2 Maximum uplink transmission timing difference requirement for inter-band synchronous EN-DC**

| Sub-carrier spacing in E-UTRA PCell (kHz) | UL Sub-carrier spacing for data in PSCell (kHz) | Maximum uplink transmission timing difference (µs) |
|---|---|---|
| 15 | 15 | 35.21 |
| 15 | 30 | 35.21 |
| 15 | 60 | 35.21 |
| 15 | 120 | 35.21 |
| NOTE 1: Void | | |

*Editor Note: It is FFS the necessity of inter-band EN-DC synchronous requirement for MTTD.*

### 7.5.3 Minimum Requirements for intra-band EN-DC

For intra-band EN-DC, only collocated deployment is applied.

The UE shall be capable of handling a maximum uplink transmission timing difference between E-UTRA PCell and PSCell as shown in Table 7.5.2-1 for E-UTRA FDD-NR FDD intra-band EN-DC provided the UE indicates that it is capable of asynchronous EN-DC operation [16]. No requirement on maximum uplink transmission timing difference is applicable for synchronous E-UTRA FDD-NR FDD and E-UTRA TDD-NR TDD intra-band EN-DC.

### 7.5.4 Minimum Requirements for NR Carrier Aggregation

The UE shall be capable of handling at least a relative transmission timing difference between slot timing of different TAGsas shown in Table 7.5.4-1, provided that the UE is:

- configured with the pTAG and the sTAG for inter-band NR carrier aggregation in SA mode. or

- configured with more than one sTAG for inter-band NR carrier aggregation in NSA mode.

**Table 7.5.4-1: Maximum transmission timing difference requirement for inter-band NR carrier aggregation**

| Frequency Range | Maximum transmission timing difference (μs) |
|---|---|
| FR1 | 34.6 |
| FR2 | 8.5 |
| Between FR1 and FR2 | 26.1 |

# 7.6 Maximum Receive Timing Difference

## 7.6.1 Introduction

A UE shall be capable of handling a relative receive timing difference between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell to be aggregated for EN-DC operation.

A UE shall be capable of handling a relative receive timing difference among slot timing boundaries of different carriers to be aggregated in NR carrier aggregation.

## 7.6.2 Minimum Requirements for inter-band EN-DC

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from E-UTRA PCell and slot timing of signal from PSCell at the UE receiver as shown in Table 7.6.2-1.

**Table 7.6.2-1: Maximum receive timing difference requirement for asynchronous EN-DC**

| Sub-carrier spacing in E-UTRA PCell (kHz) | DL Sub-carrier spacing in PSCell (kHz) (Note 1) | Maximum receive timing difference (μs) |
|---|---|---|
| 15 | 15 | 500 |
| 15 | 30 | 250 |
| 15 | 60 | 125 |
| 15 | 120[Note2] | 62.5 |
| NOTE 1: DL Sub-carrier spacing is min{$SCS_{SS}$, $SCS_{DATA}$}.<br>NOTE 2: For E-UTRA FDD-NR FDD and E-UTRA TDD-NR TDD intra-band EN-DC, for which the requirement is defined in Section 7.6.3 and this Table 7.6.2-1 is also applicable, the scenario with 120kHz does not exit. | | |

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from E-UTRA PCell and slot timing of signal from PSCell at the UE receiver as shown in Table 7.6.2-2. The requirements for synchronous EN-DC are applicable for E-UTRA TDD-NR TDD, E-UTRA FDD-NR FDD, E-UTRA TDD-NR FDD and E-UTRA FDD-NR TDD inter-band EN-DC.

**Table 7.6.2-2: Maximum receive timing difference requirement for inter-band synchronous EN-DC**

| Sub-carrier spacing in E-UTRA PCell (kHz) | DL Sub-carrier spacing in PSCell (kHz) (Note1) | Maximum receive timing difference (μs) |
|---|---|---|
| 15 | 15 | 33 |
| 15 | 30 | |
| 15 | 60 | |
| 15 | 120 | |
| NOTE 1: DL Sub-carrier spacing is min{$SCS_{SS}$, $SCS_{DATA}$}.<br>NOTE 2: Void | | |

*Editor Note: It is FFS the necessity of inter-band EN-DC synchronous requirement for MRTD.*

**Table 7.6.2-3 Void**

### 7.6.3 Minimum Requirements for intra-band EN-DC

For intra-band EN-DC, only collocated deployment is applied.

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from E-UTRA PCell and slot timing of signal from PSCell as shown in Table 7.6.2-1 for E-UTRA FDD-NR FDD intra-band EN-DC provided the UE indicates that it is capable of asynchronous EN-DC operation[16].

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from E-UTRA PCell and slot timing of signal from PSCell as shown in Table 7.6.3-1. The requirements for synchronous EN-DC are applicable for E-UTRA TDD-NR TDD and E-UTRA FDD-NR FDD intra-band EN-DC.

**Table 7.6.3-1 Maximum receive timing difference requirement for intra-band synchronous EN-DC**

| Sub-carrier spacing in E-UTRA PCell (kHz) | DL Sub-carrier spacing in PSCell (kHz) Note1 | Maximum receive timing difference (μs) |
|---|---|---|
| 15 | 15 | 3 |
| 15 | 30 | 3 |
| 15 | 60 | 3 |
| NOTE 1: DL Sub-carrier spacing is min{$SCS_{SS}$, $SCS_{DATA}$}. | | |

**Table 7.6.3-2 Void**

### 7.6.4 Minimum Requirements for NR Carrier Aggregation

For intra-band CA, only collocated deployment is applied. For intra-band non-contiguous NR carrier aggregation, the UE shall be capable of handling at least a relative receive timing difference between slot timing of different carriers to be aggregated at the UE receiver as shown in Table 7.6.4-1 below.

**Table 7.6.4-1: Maximum receive timing difference requirement for intra-band non-contiguous NR carrier aggregation**

| Frequency Range | Maximum receive timing difference (μs) |
|---|---|
| FR1 | 3 |
| FR2 | 3 |

For inter-band NR carrier aggregation, the UE shall be capable of handling at least a relative receive timing difference between slot timing of different carriers to be aggregated at the UE receiver as shown in Table 7.6.4-2 below.

**Table 7.6.4-2: Maximum receive timing difference requirement for inter-band NR carrier aggregation**

| Frequency Range | Maximum receive timing difference (μs) |
|---|---|
| FR1 | 33 |
| FR2 | 8 |
| Between FR1 and FR2 | 25 |

## 7.7 deriveSSB-IndexFromCell tolerance

### 7.7.1 Minimum requirements

When *deriveSSB-IndexFromCell* is enabled, the UE assumes frame boundary alignment (including half frame, subframe and slot boundary alignment) across cells on the same frequency carrier is within a tolerance not worse than min(2 SSB symbols, 1 PDSCH symbol) and the SFN of all cells on the same frequency carrier are the same.

## 7.8 Maximum Allowed UE Transition Times for TDD Intra-band Carrier Aggregation

### 7.8.1 Requirements

A UE is not expected to transmit in the uplink to a cell earlier than  after the end of the last received downlink symbol from the any cell in the same TDD band where  is given by Table 4.3.2-3 in TS 38.211 [6].

A UE is not expected to receive in the downlink from a cell earlier than  after the end of the last transmitted uplink symbol toward any cell in the same TDD band where  is given by Table 4.3.2-3 in TS 38.211 [6].

# 8 Signalling characteristics

## 8.1 Radio Link Monitoring

### 8.1.1 Introduction

The UE shall monitor the downlink link quality based on the reference signal in the configured RLM-RS resource(s) in order to detect the downlink radio link quality of the PCell and PSCell as specified in [3]. The configured RLM-RS resources can be all SSBs, or all CSI-RSs, or a mix of SSBs and CSI-RSs. UE is not required to perform RLM outside the active DL BWP.

On each RLM-RS resource, the UE shall estimate the downlink radio link quality and compare it to the thresholds $Q_{out}$ and $Q_{in}$ for the purpose of monitoring downlink radio link quality of the cell.

The threshold $Q_{out}$ is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to the out-of-sync block error rate ($BLER_{out}$) as defined in Table 8.1.1-1. For SSB based radio link monitoring, $Q_{out\_SSB}$ is derived based on the hypothetical PDCCH transmission parameters listed in Table 8.1.2.1-1. For CSI-RS based radio link monitoring, $Q_{out\_CSI-RS}$ is derived based on the hypothetical PDCCH transmission parameters listed in Table 8.1.3.1-1.

The threshold $Q_{in}$ is defined as the level at which the downlink radio link quality can be significantly more reliably received than at $Q_{out}$ and shall correspond to the in-sync block error rate ($BLER_{in}$) as defined in Table 8.1.1-1. For SSB based radio link monitoring, $Q_{in\_SSB}$ is derived based on the hypothetical PDCCH transmission parameters listed in Table 8.1.2.1-2. For CSI-RS based radio link monitoring, $Q_{in\_CSI-RS}$ is derived based on the hypothetical PDCCH transmission parameters listed in Table 8.1.3.1-2.

The out-of-sync block error rate ($BLER_{out}$) and in-sync block error rate ($BLER_{in}$) are determined from the network configuration via parameter *rlmInSyncOutOfSyncThreshold* signalled by higher layers. When UE is not configured with *RLM-IS-OOS-thresholdConfig* from the network, UE determines out-of-sync and in-sync block error rates from Configuration #0 in Table 8.1.1-1 as default. All requirements in Section 8.1 are applicable for BLER Configuration #0 in Table 8.1.1-1.

**Table 8.1.1-1: Out-of-sync and in-sync block error rates**

| Configuration | $BLER_{out}$ | $BLER_{in}$ |
|---|---|---|
| 0 | 10% | 2% |

UE shall be able to monitor up to $X_{RLM-RS}$ RLM-RS resources of the same or different types in each corresponding carrier frequency range, where $X_{RLM-RS}$ is specified in Table 8.1.1-2, and meet the requirements as specified in section 8.1.

**Table 8.1.1-2: Maximum number of RLM-RS resources $X_{RLM-RS}$**

| Maximum number of RLM-RS resources, $X_{RLM-RS}$ | Carrier frequency range of PCell/PSCell |
|---|---|
| 2 | FR1, ≤ 3 GHz |
| 4 | FR1, > 3 GHz |
| 8 | FR2 |

If different SCS is used for CSI-RS based RLM-RS and SSB, then CSI-RS based RLM-RS and SSB shall be TDMed. If same SCS is used for CSI-RS based RLM-RS and SSB, then CSI-RS based RLM-RS and SSB can be FDMed or TDMed.

## 8.1.2 Requirements for SSB based radio link monitoring

### 8.1.2.1 Introduction

The requirements in this section apply for each SSB based RLM-RS resource configured for PCell or PSCell, provided that the SSB configured for RLM are actually transmitted within UE active DL BWP during the entire evaluation period specified in section 8.1.2.2.

**Table 8.1.2.1-1: PDCCH transmission parameters for out-of-sync**

| Attribute | Value for BLER Configuration #0 |
|---|---|
| DCI format | 1-0 |
| Number of control OFDM symbols | 2 |
| Aggregation level (CCE) | 8 |
| Ratio of hypothetical PDCCH RE energy to average SSS RE energy | 4dB |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | 4dB |
| Bandwidth (MHz) | TBD |
| Sub-carrier spacing (kHz) | TBD |
| DMRS precoder granularity | REG bundle size |
| REG bundle size | 6 |
| CP length | Normal |
| Mapping from REG to CCE | Distributed |

**Table 8.1.2.1-2: PDCCH transmission parameters for in-sync**

| Attribute | Value for BLER Configuration #0 |
|---|---|
| DCI payload size | 1-0 |
| Number of control OFDM symbols | 2 |
| Aggregation level (CCE) | 4 |
| Ratio of hypothetical PDCCH RE energy to average SSS RE energy | 0dB |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | 0dB |
| Bandwidth (MHz) | TBD |
| Sub-carrier spacing (kHz) | TBD |
| DMRS precoder granularity | REG bundle size |
| REG bundle size | 6 |
| CP length | Normal |
| Mapping from REG to CCE | Distributed |

#### 8.1.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate\_out\_SSB}$ [ms] period becomes worse than the threshold $Q_{out\_SSB}$ within $T_{Evaluate\_out\_SSB}$ [ms] evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate\_in\_SSB}$ [ms] period becomes better than the threshold $Q_{in\_SSB}$ within $T_{Evaluate\_in\_SSB}$ [ms] evaluation period.

$T_{Evaluate\_out\_SSB}$ and $T_{Evaluate\_in\_SSB}$ are defined in Table 8.1.2.2-1 for FR1.

$T_{Evaluate\_out\_SSB}$ and $T_{Evaluate\_in\_SSB}$ are defined in Table 8.1.2.2-2 for FR2 with

- N=1,

  if the SSB configured for RLM is QCL-Type D and TDMed to CSI-RS resources configured for L1-RSRP reporting, and the QCL association is known to UE;

- N=8, otherwise.

For FR1,

- P=1/(1 – $T_{SSB}$/MGRP), when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB; and

- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- P=1/(1 – $T_{SSB}/T_{SMTCperiod}$), when RLM-RS is not overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).

- P is 3, when RLM-RS is not overlapped with measurement gap and RLM-RS is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).

- P is 1/(1- $T_{SSB}$/MGRP - $T_{SSB}/T_{SMTCperiod}$), when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and

  - $T_{SMTCperiod} \neq$ MGRP or

  - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5*T_{SMTCperiod}$

- P is 1/(1- $T_{SSB}$ /MGRP)*3, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5*T_{SMTCperiod}$

- P is 1/{1- $T_{SSB}$ /min ($T_{SMTCperiod}$ ,MGRP)}, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap

- P is 1/(1- $T_{SSB}$ /MGRP)*3, when RLM-RS is partially overlapped with measurement gap and RLM-RS is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)

If the high layer in TS 38.331 [2] signaling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*.

Longer evaluation period would be expected if the combination of RLM-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

**Table 8.1.2.2-1: Evaluation period $T_{Evaluate\_out}$ and $T_{Evaluate\_in}$ for FR1**

| Configuration | $T_{Evaluate\_out}$ (ms) | $T_{Evaluate\_in}$ (ms) |
|---|---|---|
| no DRX | max(200,ceil(10*P)*$T_{SSB}$) | max(100,ceil(5*P)*$T_{SSB}$) |
| DRX cycle≤320 | max(200,ceil(15*P)*max($T_{DRX}$,$T_{SSB}$)) | max(100,ceil(7.5*P)*max($T_{DRX}$,$T_{SSB}$)) |
| DRX cycle>320 | ceil(10*P)*$T_{DRX}$ | ceil(5*P)*$T_{DRX}$ |
| NOTE: $T_{SSB}$ is the periodicity of SSB configured for RLM. $T_{DRX}$ is the DRX cycle length. | | |

**Table 8.1.2.2-2: Evaluation period $T_{Evaluate\_out}$ and $T_{Evaluate\_in}$ for FR2**

| Configuration | $T_{Evaluate\_out}$ (ms) | $T_{Evaluate\_in}$ (ms) |
|---|---|---|
| no DRX | max(200,ceil(10*P*N)*$T_{SSB}$) | max(100,ceil(5*P*N)*$T_{SSB}$) |
| DRX cycle≤320 | max(200,ceil(15*P*N)*max($T_{DRX}$,$T_{SSB}$)) | max(100,ceil(7.5*P*N)*max($T_{DRX}$,$T_{SSB}$)) |
| DRX cycle>320 | ceil(10*P*N)*$T_{DRX}$ | ceil(5*P*N)*$T_{DRX}$ |
| NOTE: $T_{SSB}$ is the periodicity of SSB configured for RLM. $T_{DRX}$ is the DRX cycle length. | | |

## 8.1.3 Requirements for CSI-RS based radio link monitoring

### 8.1.3.1 Introduction

The requirements in this section apply for each CSI-RS based RLM-RS resource configured for PCell or PSCell, provided that the CSI-RS configured for RLM are actually transmitted within UE active DL BWP during the entire evaluation period specified in section 8.1.3.2. UE is not expected to perform radio link monitoring measurements on the CSI-RS configured as RLM-RS if the CSI-RS is not QCL-ed with any CORESET configured in the UE active BWP.

Editor's Note: FFS if the configured TCI state or the active TCI state of the CORESET should be considered.

**Table 8.1.3.1-1: PDCCH transmission parameters for out-of-sync**

| Attribute | Value for BLER Configuration #0 |
|---|---|
| DCI format | 1-0 |
| Number of control OFDM symbols | 2 |
| Aggregation level (CCE) | 8 |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | 4dB |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | 4dB |
| Bandwidth (MHz) | TBD |
| Sub-carrier spacing (kHz) | TBD |
| DMRS precoder granularity | REG bundle size |
| REG bundle size | 6 |
| CP length | Normal |
| Mapping from REG to CCE | Distributed |

**Table 8.1.3.1-2: PDCCH transmission parameters for in-sync**

| Attribute | Value for BLER Configuration #0 |
|---|---|
| DCI payload size | 1-0 |
| Number of control OFDM symbols | 2 |
| Aggregation level (CCE) | 4 |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | 0dB |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | [0]dB |
| Bandwidth (MHz) | TBD |
| Sub-carrier spacing (kHz) | TBD |
| DMRS precoder granularity | REG bundle size |
| REG bundle size | 6 |
| CP length | Normal |
| Mapping from REG to CCE | Distributed |

### 8.1.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate\_out\_CSI-RS}$ [ms] period becomes worse than the threshold $Q_{out\_CSI-RS}$ within $T_{Evaluate\_out\_CSI-RS}$ [ms] evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate\_in\_CSI-RS}$ [ms] period becomes better than the threshold $Q_{in\_CSI-RS}$ within $T_{Evaluate\_in\_CSI-RS}$ [ms] evaluation period.

- $T_{Evaluate\_out\_CSI-RS}$ and $T_{Evaluate\_in\_CSI-RS}$ are defined in Table 8.1.3.2-1 for FR1.
- $T_{Evaluate\_out\_CSI-RS}$ and $T_{Evaluate\_in\_CSI-RS}$ are defined in Table 8.1.3.2-2 for FR2, where
  - N=1,

    if the CSI-RS resource configured for RLM is QCL-Type D and TDMed to CSI-RS resources configured for L1-RSRP reporting or SSBs configured for L1-RSRP reporting, all CSI-RS resources configured for RLM are mutually TDMed, and the QCL association is known to UE;
  - N=8, otherwise.

For FR1,

- P=1/(1 – $T_{CSI-RS}$/MGRP), when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and
- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P=1, when RLM-RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- P=1/(1 – $T_{CSI-RS}$/MGRP) , when RLM-RS is partially overlapped with measurement gap and RLM-RS is not overlapped with SMTC occasion ($T_{CSI-RS}$ < MGRP)
- P=1/(1 – $T_{CSI-RS}$ /$T_{SMTCperiod}$), when RLM-RS is not overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).
- P is 3, when RLM-RS is not overlapped with measurement gap and RLM-RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).

- P is 1/(1- $T_{CSI-RS}$ /MGRP - $T_{CSI-RS}$ /$T_{SMTCperiod}$), when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion (TCSI-RS < $T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and

  - $T_{SMTCperiod} \neq$ MGRP or

  - $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} < 0.5*T_{SMTCperiod}$

- P is 1/(1- $T_{CSI-RS}$ /MGRP)* 3, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} = 0.5*T_{SMTCperiod}$

- P is 1/{1- $T_{CSI-RS}$ /min ($T_{SMTCperiod}$ ,MGRP)}, when RLM-RS is partially overlapped with measurement gap and RLM-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap

- P is 1/(1- $T_{CSI-RS}$ /MGRP)* 3, when RLM-RS is partially overlapped with measurement gap and RLM-RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)

If the high layer in TS 38.331 [2] signaling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*.

Note: The overlap between CSI-RS RLM and SMTC means that CSI-RS based RLM is within the SMTC window duration.Longer evaluation period would be expected if the combination of RLM-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

The values of $M_{out}$ and $M_{in}$ used in Table 8.1.3.2-1 and Table 8.1.3.2-2 are defined as:

- $M_{out}$ = 20 and $M_{in}$ = 10, if the CSI-RS resource configured for RLM is transmitted with Density =3.

**Table 8.1.3.2-1: Evaluation period $T_{Evaluate\_out}$ and $T_{Evaluate\_in}$ for FR1**

| Configuration | $T_{Evaluate\_out}$ (ms) | $T_{Evaluate\_in}$ (ms) |
|---|---|---|
| no DRX | max(200, ceil($M_{out}$×P)×$T_{CSI-RS}$) | max(100, ceil($M_{in}$×P) × $T_{CSI-RS}$) |
| DRX ≤ 320ms | max(200, ceil(1.5×$M_{out}$×P)× max($T_{DRX}$, $T_{CSI-RS}$)) | max(100, ceil(1.5×$M_{in}$×P)× max($T_{DRX}$, $T_{CSI-RS}$)) |
| DRX > 320ms | ceil($M_{out}$×P) × $T_{DRX}$ | ceil($M_{in}$×P) × $T_{DRX}$ |
| NOTE: $T_{CSI-RS}$ is the periodicity of CSI-RS resource configured for RLM. $T_{DRX}$ is the DRX cycle length. | | |

**Table 8.1.3.2-2: Evaluation period $T_{Evaluate\_out}$ and $T_{Evaluate\_in}$ for FR2**

| Configuration | $T_{Evaluate\_out}$ (ms) | $T_{Evaluate\_in}$ (ms) |
|---|---|---|
| no DRX | max(200, ceil($M_{out}$×P×N)×$T_{CSI-RS}$) | max(100, ceil($M_{in}$×P×N) × $T_{CSI-RS}$) |
| DRX ≤ 320ms | max(200, ceil(1.5×$M_{out}$×P×N)× max($T_{DRX}$, $T_{CSI-RS}$)) | max(100, ceil(1.5×$M_{in}$×P×N)× max($T_{DRX}$, $T_{CSI-RS}$)) |
| DRX > 320ms | ceil($M_{out}$×P×N) × $T_{DRX}$ | ceil($M_{in}$×P×N) × $T_{DRX}$ |
| NOTE: $T_{CSI-RS}$ is the periodicity of CSI-RS resource configured for RLM. $T_{DRX}$ is the DRX cycle length. | | |

## 8.1.4 Minimum requirement at transitions

When the UE transitions between DRX and no DRX or when DRX cycle periodicity changes, for each RLM-RS resource, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation period corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode for each RLM-RS resource. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of themonitored cell.

When the UE transitions from a first configuration of RLM-RS resources to a second configuration of RLM-RS resources that is different from the first configuration, for each RLM-RS resource present in the second configuration, for a duration of time equal to the evaluation period corresponding to the second configuration after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first configuration and the second configuration. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second configuration for each RLM-RS resource present in the second configuration. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of themonitored cell.

### 8.1.5 Minimum requirement for UE turning off the transmitter

The transmitter power of the UE in the monitored cell shall be turned off within 40ms after expiry of T310 timer as specified in TS 38.331 [2].

### 8.1.6 Minimum requirement for L1 indication

When the downlink radio link quality on all the configured RLM-RS resources is worse than $Q_{out}$, Layer 1 of the UE shall send an out-of-sync indication for the cell to the higher layers. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 38.331 [2].

When the downlink radio link quality on at least one of the configured RLM-RS resources is better than $Q_{in}$, Layer 1 of the UE shall send an in-sync indication for the cell to the higher layers. A Layer 3 filter shall be applied to the in-sync indications as specified in TS 38.331 [2].

The out-of-sync and in-sync evaluations for the configured RLM-RS resources shall be performed as specified in clause 5 in TS 38.213 [3]. Two successive indications from Layer 1 shall be separated by at least $T_{Indication\_interval}$.

When DRX is not used $T_{Indication\_interval}$ is max(10ms, $T_{RLM-RS,M}$), where $T_{RLM,M}$ is the shortest periodicity of all configured RLM-RS resources for the monitored cell, which corresponds to $T_{SSB}$ specified in section 8.1.2 if the RLM-RS resource is SSB, or $T_{CSI-RS}$ specified in section 8.1.3 if the RLM-RS resource is CSI-RS.

In case DRX is used, $T_{Indication\_interval}$ is max(10ms, 1.5*DRX_cycle_length, 1.5*$T_{RLM-RS,M}$) if DRX cycle_length is less than or equal to 320ms, and $T_{Indication\_interval}$ is DRX_cycle_length if DRX cycle_length is greater than 320ms. Upon start of T310 timer as specified in TS 38.331 [2], the UE shall monitor the configured RLM-RS resources for recovery using the evaluation period and Layer 1 indication interval corresponding to the no DRX mode until the expiry or stop of T310 timer.

### 8.1.7 Scheduling availability of UE during radio link monitoring

When the reference signal to be measured for RLM has different subcarrier spacing than PDSCH/PDCCH and on frequency range FR2, there are restrictions on the scheduling availability as described in the following clauses.

#### 8.1.7.1 Scheduling availability of UE performing radio link monitoring with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to radio link monitoring performed with a same subcarrier spacing as PDSCH/PDCCH on FR1.

#### 8.1.7.2 Scheduling availability of UE performing radio link monitoring with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to radio link monitoring based on SSB as RLM-RS. For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to radio link monitoring based on SSB as RLM-RS.

- The UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on SSB symbols to be measured for radio link monitoring.

When intra-band carrier aggregation is performed, the scheduling restrictions apply to all serving cells on the band due to radio link monitoring performed on FR1 serving PCell or PSCell in the same band. When inter-band carrier aggregation within FR1 is performed, there are no scheduling restrictions on FR1 serving cell(s) in the bands due to radio link monitoring performed on FR1 serving PCell or PSCell in different bands.

### 8.1.7 Scheduling availability of UE during radio link monitoring

When the reference signal to be measured for RLM has different subcarrier spacing than PDSCH/PDCCH and on frequency range FR2, there are restrictions on the scheduling availability as described in the following clauses.

#### 8.1.7.1 Scheduling availability of UE performing radio link monitoring with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to radio link monitoring performed with a same subcarrier spacing as PDSCH/PDCCH on FR1.

#### 8.1.7.2 Scheduling availability of UE performing radio link monitoring with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to radio link monitoring based on SSB as RLM-RS. For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to radio link monitoring based on SSB as RLM-RS.

- The UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on SSB symbols to be measured for radio link monitoring.

When intra-band carrier aggregation is performed, the scheduling restrictions apply to all serving cells on the band due to radio link monitoring performed on FR1 serving PCell or PSCell in the same band. When inter-band carrier aggregation within FR1 is performed, there are no scheduling restrictions on FR1 serving cell(s) in the bands due to radio link monitoring performed on FR1 serving PCell or PSCell in different bands.

#### 8.1.7.3 Scheduling availability of UE performing radio link monitoring on FR2

The following scheduling restriction applies due to radio link monitoring on an FR2 serving PCell and/or PSCell.

- If the RLM-RS is type-D QCLed with active TCI state for PDCCH/PDSCH, and N=1 applies for the RLM-RS as specified in section 8.1.2.2 if the RLM-RS is SSB and in section 8.1.3.2 if the RLM-RS is CSI-RS
  - There are no scheduling restrictions due to radio link monitoring based on SSB or CSI-RS with a same subcarrier spacing as PDSCH/PDCCH.
  - When performing radio link monitoring based on SSB with a different subcarrier spacing than PDSCH/PDCCH, for UE which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to radio link monitoring. For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on SSB symbols to be measured for radio link monitoring.
- Otherwise
  - The UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on RLM-RS symbols to be measured for radio link monitoring.

When intra-band carrier aggregation is performed, the scheduling restrictions apply to all serving cells on the band due to radio link monitoring performed on FR2 serving PCell or PSCell in the same band.

Editor's Note: FFS scheduling restrictions for inter-band carrier aggregation will be defined depending on band combination in future.

#### 8.1.7.4 Scheduling availability of UE performing radio link monitoring on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to radio link monitoring performed on FR2 serving PCell and/or PSCell.

There are no scheduling restrictions on FR2 serving cell(s) due to radio link monitoring performed on FR1 serving PCell and/or PSCell.

## 8.2 Interruption

### 8.2.1 NSA: Interruptions with EN-DC

#### 8.2.1.1 Introduction

This section contains the requirements related to the interruptions on PSCell, and SCell, when

E-UTRA PCell transitions between active and non-active during DRX, or

E-UTRA PCell transitions from non-DRX to DRX, or

E-UTRA SCell in MCG or SCell in SCG is added or released, or

E-UTRA SCell in MCG or SCell in SCG is activated or deactivated, or

measurements on SCC with deactivated SCell in either E-UTRA MCG or NR SCG

This section also contains the requirements related to the interruptions on other active serving cells in the same frequency range wherein the UE is performing BWP switching.

The requirements shall apply for E-UTRA-NR DC with an E-UTRA PCell.

This section contains interruptions where victim cell is PSCell or SCell belonging to SCG. Requirements for interruptions requirements when the victim cell is E-UTRA PCell or E-UTRA SCell belonging to MCG are specified in [15].

For a UE which does not support per-FR measurement gaps, interruptions to the PSCell or active SCG SCells may be caused by EUTRA PCell, EUTRA SCells or SCells on any frequency range. For UE which support per-FR gaps, interruptions to the PSCell or active SCG SCells may be caused by EUTRA PCell, EUTRA SCells or SCells on the same frequency range as the victim cell.

### 8.2.1.2 Requirements

#### 8.2.1.2.1 Interruptions at transitions between active and non-active during DRX

Interruption on PSCell and the activated SCell if configured due to E-UTRA PCell transitions between active and non-active druing DRX when PSCell or SCell is in non-DRX are allowed with up to 1% probability of missed ACK/NACK when the configured E-UTRA PCell DRX cycle is less than 640 ms, and 0.625% probability of missed ACK/NACK is allowed when the configured E-UTRA PCell DRX cycle is 640 ms or longer. Each interruption shall not exceed X slot as defined in table 8.2.1.2.1-1.

Each interruption shall not exceed X slot as defined in table 8.2.1.2.1-1.

**Table 8.2.1.2.1-1: Interruption length X at transition between active and non-active during DRX**

| $\mu$ | NR Slot length (ms) | Interruption length X | |
|---|---|---|---|
| | | Sync | Async |
| 0 | 1 | 1 | 2 |
| 1 | 0.5 | 1 | 2 |
| 2 | 0.25 | 3 | |
| 3 | 0.125 | 5 | |

When both E-UTRA PCell and PSCell are in DRX, no interruption is allowed.

#### 8.2.1.2.2 Interruptions at transitions from non-DRX to DRX

Interruption on PSCell and the activated SCell if configured due to E-UTRA PCell transitions from non-DRX to DRX when PSCell or SCell is in non-DRX shall not exceed X slot as defined in table 8.2.1.2.1-1.

#### 8.2.1.2.3 Interruptions at SCell addition/release

The requirements in this clause shall apply for the UE configured with PSCell.

When one E-UTRA SCell is added or released:

- an interruption on any activated serving cell in SCG:
  - of up to X1 slot, if the activated serving cell is not in the same band as any of the E-UTRA SCells being added or released, or
  - of up to max{Y1 slot + $T_{SMTC\_duration}$, 5ms} if the activated serving cells are in the same band as any of the E-UTRA SCells being added or released, provided the cell specific reference signals from the activated serving

cells and the E-UTRA SCells being added or released are available in the same slot, where $T_{SMTC\_duration}$ is the longest SMTC duration among all above activated serving cells in SCG;

Where X1 and Y1 are specified in in Table 8.2.1.2.3-1.

When one SCell is added or released:

- an interruption on any activated serving cell in SCG:
  - of up to X1 slot, if the activated serving cell is not in the same band as any of the SCells being added or released, or
  - of up to Y1 slot + $T_{SMTC\_duration}$ if the activated serving cells are in the same band as any of the SCells being added or released, provided the cell specific reference signals from the activated serving cells and the SCells being added or released are available in the same slot, where, $T_{SMTC\_duration}$ is
    - the longest SMTC duration among all above activated serving cells in SCG and the SCell being added when one SCell is added;
    - the longest SMTC duration among all above activated serving cells in SCG when one SCell is released.

Where X1 and Y1 are specified in in Table 8.2.1.2.3-2.

**Table 8.2.1.2.3-1: Interruption length X1 and Y1 at SCell addition/Release**

| $\mu$ | NR Slot length (ms) | Interruption length X1 slot | | Interruption length Y1 slot Note 1 |
|---|---|---|---|---|
| | | Sync | Async | |
| 0 | 1 | 1 | 2 | 1 |
| 1 | 0.5 | 2 | 3 | 2 |
| 2 | 0.25 | 5 | | 4 |
| 3 | 0.125 | 9 | | 8 |

**Table 8.2.1.2.3-2: Interruption length X1 and Y1 at SCell addition/Release**

| $\mu$ | NR Slot length (ms) | Interruption length X1 slot | Interruption length Y1 slot Note |
|---|---|---|---|
| 0 | 1 | 1 | 1 |
| 1 | 0.5 | 2 | 2 |
| 2 | 0.25 | 4 | 4 |
| 3 | 0.125 | 8 | 8 |

### 8.2.1.2.4 Interruptions at SCell activation/deactivation

The requirements in this clause shall apply for the UE configured with PSCell and one SCell.

When one E-UTRA SCell is activated or deactivated:

- an interruption on any activated serving cell in SCG:
  - of up to X2 slot, if the activated serving cell is not in the same band as any of the E-UTRA SCells being activated or deactivated, or
- of up to max{Y2 slot + $T_{SMTC\_duration}$, 5ms} if the activated serving cells are in the same band as any of the E-UTRA SCells being activated or deactivated, provided the cell specific reference signals from the activated serving cells and the E-UTRA SCells being activated or deactivated are available in the same slot, where $T_{SMTC\_duration}$ is the longest SMTC duration among all above activated serving cells in SCG.

Where X2 and Y2 are specified in in Table 8.2.1.2.4-1.

When one SCell is activated or deactivated:

- an interruption on any serving cell in SCG:
  - of up to X2 slot, if the activated serving cell is not in the same band as any of the SCells being activated or deactivated, or

- of up to Y2 slot + $T_{SMTC\_duration}$ if the activated serving cells are in the same band as any of the SCells being activated or deactivated, provided the cell specific reference signals from the activated serving cells and the SCells being activated or deactivated are available in the same slot, where, $T_{SMTC\_duration}$ is
  - the longest SMTC duration among all above activated serving cells in SCG and the SCell being activated when one SCell is activated;
  - the longest SMTC duration among all above activated serving cells in SCG when one SCell is deactivated.

Where X2 and Y2 are specified in in Table 8.2.1.2.4-2.

**Table 8.2.1.2.4-1: Interruption length X2 and Y2 at SCell activation/deactivation**

| $\mu$ | NR Slot length (ms) | Interruption length X2 slot | | Interruption length Y2 slot |
|---|---|---|---|---|
| | | Sync | Async | |
| 0 | 1 | 1 | 2 | 1 |
| 1 | 0.5 | 1 | 2 | 1 |
| 2 | 0.25 | 3 | | 2 |
| 3 | 0.125 | 5 | | 4 |

**Table 8.2.1.2.4-2: Interruption length X2 and Y2 at SCell activation/deactivation**

| $\mu$ | NR Slot length (ms) | Interruption length X2 slot | Interruption length Y2 slot |
|---|---|---|---|
| 0 | 1 | 1 | 1 |
| 1 | 0.5 | 1 | 1 |
| 2 | 0.25 | 2 | 2 |
| 3 | 0.125 | 4 | 4 |

### 8.2.1.2.5 Interruptions during measurements on SCC

#### 8.2.1.2.5.1 Interruptions during measurements on deactivated NR SCC

Interruption on PSCell and other active NR SCell(s) during measurement on the deactivated NR SCC shall meet requirements in clause 8.2.2.2.3, where the term PCell in clause 8.2.2.2.3 shall be deemed to be replaced with PSCell.

#### 8.2.1.2.5.2 Interruptions during measurements on deactivated E-UTRAN SCC

When one E-UTRA SCell in MCG is deactivated, the UE is allowed due to measurements on the E-UTRA SCC with the deactivated E-UTRA SCell:

- an interruption on PSCell or any activated SCell with up to 0.5% probability of missed ACK/NACK when any of the configured *measCycleSCell* [2] for the deactivated E-UTRA SCells is 640 ms or longer.
- an interruption on PSCell or any activated SCell with up to 0.5% probability of missed ACK/NACK regardless of the configured *measCycleSCell* [2] for the deactivated E-UTRA SCells if indicated by the network using IE *allowInterruptions* [2].

Each interruption shall not exceed

- X3 slot, if the PSCell or activated SCell is not in the same band as the E-UTRA deactivated SCC being measured, or
- Y3 slot + SMTC duration, if the PSCell or activated SCell is in the same band as the E-UTRA deactivated SCC being measured, provided the cell specific reference signals from the PSCell or activated SCell and the E-UTRA deactivated SCC being measured are available in the same slot.

**Table 8.2.1.2.5-1: Interruption length X3 and Y3 at measurements on deactivated E-UTRA SCC**

| $\mu$ | NR Slot length (ms) | Interruption length X3 slot | Interruption length Y3 slot |
|---|---|---|---|
| 0 | 1 | 1 | 1 |
| 1 | 0.5 | 1 | 1 |
| 2 | 0.25 | 2 | 2 |
| 3 | 0.125 | 4 | 4 |

### 8.2.1.2.6 Interruptions at UL carrier RRC reconfiguration

The requirements in this clause shall apply when a supplementary UL carrier or an UL carrier is configured or de-configured in NR non-standalone operation as defined in [2].

When an UL carrier or supplementary UL carrier is configured or deconfigured, an interruption on E-UTRA PCell, all activated E-UTRA SCells, PSCell and all activated SCells within the same FR as the reconfigured uplink carrier of up to X4 slot, is allowed during the RRC reconfiguration procedure [2]. The interruption is for both uplink and downlink of E-UTRA PCell, all activated E-UTRA SCells, PSCell and all activated SCells within the same FR as the configured or de-configured UL.

**Table 8.2.1.2.6-1: Interruption length X4 at UL carrier RRC reconfiguration**

| $\mu$ | NR Slot length (ms) | Interruption length X4 slot | |
|---|---|---|---|
| | | Sync | Async |
| 0 | 1 | 1 | 2 |
| 1 | 0.5 | 2 | 3 |
| 2 | 0.25 | 5 | |
| 3 | 0.125 | 9 | |

### 8.2.1.2.7 Interruption due to Active BWP switching Requirement

When UE receives a DCI indicating UE to switch its active BWP involving changes in any of the parameters listed in Table 8.2.1.2.7-2, the UE is allowed to cause interruption of up to X slot to other active serving cells if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in Table 8.2.1.2.7-2and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in Table 8.2.1.2.7-1. The starting time of interruption is only allowed within the BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6.2. Interruptions are not allowed during BWP switch involving other parameter change.

When a BWP timer *bwp-InactivityTimer* defined in [2] expires, UE is allowed to cause interruption of up to X slot to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in Table 8.2.1.2.7-2 if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in Table 8.2.1.2.7-2 and the UE is capable of per-FR gap the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in Table 8.2.1.2.7-1. The starting time of interruption is only allowed within the BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6.2. Interruptions are not allowed during BWP switch involving other parameter change.

*Editor's note: FFS whether interruption core requirement for RRC re-configuration with BWP switch and/or MAC-based BWP switching (upon initiation of random access procedure in certain cases) is needed.Editor's note: FFS whether* one more interrupted slot is allowed when the interrupted serving cells and the serving cell that UE is performing BWP switching are in the same band,

**Table 8.2.1.2.7-1: interruption length X**

| $\mu$ | NR Slot length (ms) | Interruption length X (slots[note 1]) |
|---|---|---|

| | | |
|---|---|---|
| 0 | 1 | 1 |
| 1 | 0.5 | 1 |
| 2 | 0.25 | 3 |
| 3 | 0.125 | 5 |
| Note1: If the BWP switch involves changing of SCS, the interruption due to BWP switch is determined by the larger one between the SCS before BWP switch and the SCS after the BWP switch. | | |

**Table 8.2.1.2.7-2: Parameters which cause interruption other than SCS**

| Parameters | Comment |
|---|---|
| *locationAndBandwidth* | From TS 38.331 [2] |
| *maxNrofCodeWordsScheduledByDCI* | |
| *nrofSRS-Ports* | |
| *Editor's note: More parameters can be added if identified* | |

## 8.2.2 SA: Interruptions with Standalone NR Carrier Aggregation

### 8.2.2.1 Introduction

This section contains the requirements related to the interruptions on PCell and activated SCell if configured, when up to TBD SCells are configured, deconfigured, activated or deactivated.

Note: interruptions at SCell addition/release, activation/deactivation and during measurements on SCC may not be required by all UEs.

Editor's Note: The interruptions shall not interrupt RRC signalling or ACK/NACKs related to RRC reconfiguration procedure [2] for SCell addition/release or MAC control signalling [17] for SCell activation/deactivation command. How to specify this is FFS.

This section also contains the requirements related to the interruptions on other active serving cells in the same frequency range wherein the UE is performing BWP switching.

For a UE which does not support per-FR measurement gaps, interruptions to the PCell and activated SCell may be caused by SCells on any frequency range. For UE which support per-FR gaps, interruptions to PCell and activated SCell may be caused by SCells on the same frequency range as the victim cell.

### 8.2.2.2 Requirements

#### 8.2.2.2.1 Interruptions at SCell addition/release

When any number of SCells between one and TBD is added or released using the same *RRCConnectionReconfiguration* message as defined in [2], the UE is allowed an interruption on any activated serving cell during the RRC reconfiguration procedure as follows:

- an interruption on any activated serving cell:
  - of up to the duration shown in table 8.2.2.2.1-1, if the activated  is not in the same band as any of the SCells being added or released, or
  - of up to the duration shown in table 8.2.2.2.1-2, if the activated serving cells are in the same band as any of the SCells being added or released, provided the cell specific reference signals from the activated serving cells and the SCells being added or released are available in the same slot.

**Table 8.2.2.2.1-1: Interruption duration for SCell addition/release for inter-band CA**

| $\mu$ | NR Slot length (ms) | Interruption length (slot) |
|---|---|---|
| 0 | 1 | 1 |
| 1 | 0.5 | 2 |
| 2 | 0.25 | 4 |
| 3 | 0.125 | 8 |

**Table 8.2.2.2.1-2: Interruption duration for SCell addition/release for intra-band CA**

| $\mu$ | NR Slot length (ms) | Interruption length (slot) |
|---|---|---|
| 0 | 1 | 1 + $T_{SMTC\_duration}$ |
| 1 | 0.5 | 2 + $T_{SMTC\_duration}$ |
| 2 | 0.25 | 4 + $T_{SMTC\_duration}$ |
| 3 | 0.125 | 8 + $T_{SMTC\_duration}$ |
| Note: $T_{SMTC\_duration}$ is<br>- the longest SMTC duration among all above activated serving cells and the SCell being added when one SCell is added;<br>- the longest SMTC duration among all activated serving cells in the same band when one SCell is released. | | |

### 8.2.2.2.2 Interruptions at SCell activation/deactivation

When an intra-band SCell is activated or deactivated as defined in [17], the UE is allowed

- an interruption on any activated serving cell:
  - of up to the duration shown in table 8.2.2.2.2-1, if the activated serving cell is not in the same band as any of the SCells being activated or deactivated, or
  - of up to the duration shown in table 8.2.2.2.2-2, if the activated serving cells are in the same band as any of the SCells being activated or deactivated provided the cell specific reference signals from the activated serving cells and the SCells being activated or deactivated are available in the same slot.

**Table 8.2.2.2.2-1: Interruption duration for SCell activation/deactivation for inter-band CA**

| $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 0 | 1 | 1 |
| 1 | 0.5 | 1 |
| 2 | 0.25 | 2 |
| 3 | 0.125 | 4 |

**Table 8.2.2.2.2-2: Interruption duration for SCell activation/deactivation for intra-band CA**

| $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 0 | 1 | 1 + $T_{SMTC\_duration}$ |
| 1 | 0.5 | 1 + $T_{SMTC\_duration}$ |
| 2 | 0.25 | 2 + $T_{SMTC\_duration}$ |
| 3 | 0.125 | 4 + $T_{SMTC\_duration}$ |
| Note: | $T_{SMTC\_duration}$ is<br>- the longest SMTC duration among all above activated serving cells and the SCell being activated when one SCell is activated;<br>- the longest SMTC duration among all activated serving cells in the same band when one SCell is deactivated. | |

### 8.2.2.2.3 Interruptions during measurements on SCC for intra-band CA

Interruptions on PCell due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in Table 8.2.2.2.2-1 if the PCell is not in the same band as the deactivated SCell. Each interruption shall not exceed requirement in Table 8.2.2.2.2-2 if the PCell is in the same band as the deactivated SCell.

Interruptions on active SCell due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in Table 8.2.2.2.2-1 if the active SCell is not in the same band as the deactivated SCell. Each interruption shall not exceed requirement in Table 8.2.2.2.2-2 if the active SCell is in the same band as the deactivated SCell.

### 8.2.2.2.4 Interruptions at UL carrier RRC reconfiguration

The requirements in this clause shall apply when a supplementary UL carrier or an UL carrier is configured or de-configured in NR standalone carrier aggregation as defined in [2].

When an UL carrier or supplementary UL carrier is configured or deconfigured, an interruption on PCell and all activated SCells within the same FR as the reconfigured uplink carrier of up to the duration shown in table 8.2.2.2.4-1, is allowed during the RRC reconfiguration procedure [2]. The interruption is for both uplink and downlink of PCell and all the activated SCells within the same FR as the configured or de-configured UL.

| Table 8.2.2.2.4-1: Interruption duration for UL carrier RRC reconfiguration $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 0 | 1 | 1 |
| 1 | 0.5 | 2 |
| 2 | 0.25 | 4 |
| 3 | 0.125 | 8 |

### 8.2.2.2.5 Interruption due to Active BWP switching Requirement

When UE receives a DCI indicating UE to switch its active BWP involving changes in any of the parameters listed in Table 8.2.2.2.5-2, the UE is allowed to cause interruption of up to X slot to other active serving cells if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in Table 8.2.2.2.5-2 and the UE is capable of per-FR gap the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in Table 8.2.2.2.5-1. The starting time of interruption is only allowed within the BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6.2. Interruptions are not allowed during BWP switch involving other parameter change.

When a BWP timer *bwp-InactivityTimer* defined in [2] expires, UE is allowed to cause interruption of up to X slot to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in Table 8.2.2.2.5-2 if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in Table 8.2.2.2.5-2and the UE is capable of per-FR gap the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in Table 8.2.2.2.5-1. The starting time of interruption is only allowed within the BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6.2. Interruptions are not allowed during BWP switch involving other parameter change.

*Editor's note: FFS whether interruption core requirement for RRC re-configuration with BWP switch and/or MAC-based BWP switching (upon initiation of random access procedure in certain cases) is needed.*

*Editor's note: FFS whether* one more interrupted slot is allowed when the interrupted serving cells and the serving cell that UE is performing BWP switching are in the same band,

**Table 8.2.2.2.5-1: Interruption length X**

| $\mu$ | NR Slot length (ms) | Interruption length X (slots[note 1]) |
|---|---|---|
| 0 | 1 | 1 |
| 1 | 0.5 | 1 |
| 2 | 0.25 | 3 |
| 3 | 0.125 | 5 |
| Note1: If the BWP switch involves changing of SCS, the interruption due to BWP switch is determined by the larger one between the SCS before BWP switch and the SCS after the BWP switch. | | |

**Table 8.2.2.2.5-2: Parameters which cause interruption other than SCS**

| Parameters | Comment |
|---|---|
| *locationAndBandwidth* | From TS 38.331 [2] |
| *maxNrofCodeWordsScheduledByDCI* | |
| *nrofSRS-Ports* | |
| *Editor's note: More parameters can be added if identified* | |

# 8.3 SCell Activation and Deactivation Delay

## 8.3.1 Introduction

This section defines requirements for the delay within which the UE shall be able to activate a deactivated SCell and deactivate an activated SCell in SCG in EN-DC, or in standalone NR carrier aggregation.

The requirements shall apply for EN-DC and standalone NR carrier aggregation.

## 8.3.2 SCell Activation Delay Requirement for Deactivated SCell

The requirements in this section shall apply for the UE configured with one downlink SCell in SCG in EN-DC, or in standalone NR carrier aggregation and when one SCell is being activated.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot *n*+ [$T_{HARQ}$ + $T_{activation\_time}$ + $T_{CSI\_Reporting}$], where:

$T_{HARQ}$ is the timing between DL data transmission and acknowledgement as specified in [7].

$T_{activation\_time}$ is the SCell activation delay. If the SCell is known and belongs to FR1, $T_{activation\_time}$ is:

- [$T_{SMTC\_SCell}$ + 5ms], if the SCell measurement cycle is equal to or smaller than [160ms].
- [$T_{SMTC\_MAX}$ + $T_{SMTC\_SCell}$ + 5ms], if the SCell measurement cycle is larger than [160ms].

If the SCell is unknown and belongs to FR1, $T_{activation\_time}$ is:

- [2*$T_{SMTC\_MAX}$ + 2*$T_{SMTC\_SCell}$ + 5ms] provided the SCell can be successfully detected on the first attempt.

If the SCell being activated belongs to FR2, $T_{activation\_time}$ is:

- [$T_{SMTC\_SCell}$ + 5ms] if there is at least one active serving cell on that FR2 band, provided that the SSBs in the serving cell(s) and the SSBs in the SCell fulfil the condition defined in section 3.6.3.
- [TBD* $T_{SMTC\_SCell}$ + 5ms] if there is no active serving cell on that FR2 band provided that PCell or PSCell is FR1.

Where,

$T_{SMTC\_MAX}$:

- In FR1, in case of intra-band SCell activation, $T_{SMTC\_MAX}$ is the longer SMTC periodicity between active serving cells and SCell being activated provided the cell specific reference signals from the active serving cells and the SCells being activated or released are available in the same slot; in case of inter-band SCell activation, $T_{SMTC\_MAX}$ is the SMTC periodicity of SCell being activated.
- In FR2, $T_{SMTC\_MAX}$ is the longer SMTC periodicity between active serving cells and SCell being activated provided that in Rel-15 only support FR2 intra-band CA.
- $T_{SMTC\_MAX}$ is bounded to a minimum value of 10ms.

$T_{SMTC\_SCell}$: SMTC periodicity of SCell being activated and the minimum value is 10ms.

$T_{CSI\_reporting}$ is the delay including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources as specified in [2].

SCell in FR1 is known if it has been meeting the following conditions:

- During the period equal to max([5] measCycleSCell, [5] DRX cycles) for FR1 before the reception of the SCell activation command:
  - the UE has sent a valid measurement report for the SCell being activated and
  - the SSB measured remains detectable according to the cell identification conditions specified in section 9.2 and 9.3.
- the SSB measured during the period equal to max([5] measCycleSCell, [5] DRX cycles) also remains detectable during the SCell activation delay according to the cell identification conditions specified in section 9.2 and 9.3.

Otherwise SCell in FR1 is unknown.

If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2* prior to the activation command, $T_{SMTC\_Scell}$ follows *smtc1* or *smtc2* according to the physical cell ID of the target cell being activated. $T_{SMTC\_MAX}$ follows *smtc1* or *smtc2* according to the physical cell IDs of the target cells being activated and the active serving cells.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in [2] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

The interruption on PSCell or any activated SCell in SCGfor EN-DC mode specified in section 8.2 shall not occur before slot n+1+[$T_{HARQ}$] and not occur after slot n+1+[$T_{HARQ}$ +3ms + $T_{SMTC\_MAX}$ + $T_{SMTC\_duration}$ ].

The interruption on PCell or any activated SCell in MCG for NR standalone mode specified in section 8.2 shall not occur before slot n+1+[$T_{HARQ}$] and not occur after slot n+1+[$T_{HARQ}$ +3ms + $T_{SMTC\_MAX}$ + $T_{SMTC\_duration}$].

Starting from the slot specified in section 4.3 of [3] (timing for secondary Cell activation/deactivation) and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

### 8.3.3 SCell Deactivation Delay Requirement for Activated SCell

The requirements in this section shall apply for the UE configured with one downlink SCell in SCG in EN-DC, or in standalone NR carrier aggregation.

Upon receiving SCell deactivation command or upon expiry of the *sCellDeactivationTimer* in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated no later than in slot $n$+[$T_{HARQ}$ +3ms ].

The interruption on PSCell or any activated SCell in SCG for EN-DC mode specified in section 8.2 shall not occur before slot n+1+[$T_{HARQ}$] and not occur after slot n+1+[$T_{HARQ}$ +3ms].

The interruption on PCell or any activated SCell in MCG for NR standalone mode specified in section 8.2 shall not occur before slot n+1+[$T_{HARQ}$] and not occur after slot n+1+[$T_{HARQ}$ +3ms].

## 8.4 UE UL carrier RRC reconfiguration Delay

### 8.4.1 Introduction

The requirements in this section apply for a UE being configured or deconfigured with a supplementary UL carrier or NR UL carrier.

### 8.4.2 UE UL carrier configuration Delay Requirement

When the UE receives a RRC message implying NR UL or Supplementary UL carrier configuration, the UE shall be ready to start transmission on the newly configured carrier within $T_{UL\_carrier\_config}$ from the end of the last slot containing the RRC command.

$T_{UL\_carrier\_config}$ equals the maximum RRC procedure delay defined in clause x.y in TS 38.331 [2] plus the interruption time specified in section 8.2.1.2.6.

### 8.4.3 UE UL carrier deconfiguration Delay Requirement

When the UE receives a RRC message implying NR UL or Supplementary UL carrier deconfiguration RRC signalling, the UE shall stop UL signalling on the deconfigured UL carrier within $T_{UL\_carrier\_deconfig}$ from the end of the last slot containing the RRC command.

$T_{UL\_carrier\_deconfig}$ equals the maximum RRC procedure delay defined in clause x.y in TS 38.331 [2].

## 8.5 Link Recovery Procedures

### 8.5.1 Introduction

The UE shall assess the downlink link quality of a serving cell based on the reference signal in the set $\overline{q}_0$ as specified in TS 38.213 [3] in order to detect beam failure instance. The RS resources in the set $\overline{q}_0$ can be periodic CSI-RS resources and/or SSBs. UE is not required to perform beam failure detection outside the active DL BWP.

On each RS resource in the set $\overline{q}_0$, the UE shall estimate the radio link quality and compare it to the threshold $Q_{out\_LR}$ for the purpose of accessing downlink radio link quality of the serving cell.

The threshold $Q_{out\_LR}$ is defined as the level at which the downlink radio level link cannot be reliably received and shall correspond to the $BLER_{out}$=10% block error rate of a hypothetical PDCCH transmission. For SSB based beam failure detection, $Q_{out\_LR\_SSB}$ is derived based on the hypothetical PDCCH transmission parameters listed in Table 8.5.2.1-1. For CSI-RS based beam failure detection, $Q_{out\_LR\_CSI-RS}$ is derived based on the hypothetical PDCCH transmission parameters listed in Table 8.5.3.1-1.

The UE shall perform L1-RSRP measurements based on the reference signal in the set $\overline{q}_1$ as specified in TS 38.213 [3] in order to detect candidate beam with L1-RSRP measurement that is better than the threshold indicated by higher layer parameter rsrp-ThresholdSSB and rsrp-ThresholdCSI-rs (rsrp-ThresholdSSB + powerControlOffsetSS). The RS resources in the set $\overline{q}_1$ can be periodic CSI-RS resources or SSBs or both SSB and CSI-RS. UE is not required to perform candidate beam detection outside the active DL BWP.

On each RS resource in the set $\overline{q}_1$, the UE shall perform L1-RSRP measurements and compare it to the threshold rsrp-ThresholdSSB or rsrp-ThresholdCSI-rs for the purpose of selecting new beam(s) for beam failure recovery.

UE is not expected to perform beam failure detection measurements if the SCS of the CSI-RS used for beam failure detection and the SCS of the SSB used for beam failure detection are different, and the CSI-RS and SSB are FDM-ed in the same OFDM symbol.

*Editor's Note: FFS: whether UE supporting simultaneousRxDataSSB-DiffNumerology can perform BFD on SSB and CSI-RS simultaneously.*

## 8.5.2 Requirements for SSB based beam failure detection

### 8.5.2.1 Introduction

The requirements in this section apply for each SSB resource in the set $\overline{q}_0$ configured for a serving cell, provided that the SSB configured for beam failure detection are actually transmitted within the UE active DL BWP during the entire evaluation period specified in section 8.5.2.2.

**Table 8.5.2.1-1: PDCCH transmission parameters for beam failure instance**

| Attribute | Value for BLER |
|---|---|
| DCI format | 1-0 |
| Number of control OFDM symbols | 2 |
| Aggregation level (CCE) | 8 |
| Ratio of hypothetical PDCCH RE energy to average SSS RE energy | 0dB |
| Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | 0dB |
| Bandwidth (MHz) | TBD |
| Sub-carrier spacing (kHz) | Same as the SCS of RMSI CORESET |
| DMRS precoder granularity | REG bundle size |
| REG bundle size | 6 |
| CP length | Normal |
| Mapping from REG to CCE | Distributed |

### 8.5.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured SSB resource in set $\overline{q}_0$ estimated over the last $T_{Evaluate\_BFD\_SSB}$ [ms] period becomes worse than the threshold $Q_{out\_LR\_SSB}$ within $T_{Evaluate\_BFD\_SSB}$ [ms] period.

The value of $T_{Evaluate\_BFD\_SSB}$ is defined in Table 8.5.2.2-1 for FR1.

The value of $T_{Evaluate\_BFD\_SSB}$ is defined in Table 8.5.2.2-2 for FR2 with N=8

For FR1,

- P=1/(1 – $T_{SSB}$/MGRP), when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB; and
- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- $P=1/(1 - T_{SSB}/T_{SMTCperiod})$, when BFD-RS is not overlapped with measurement gap and BFD-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- P is $P_{sharing\ factor}$, when BFD-RS is not overlapped with measurement gap and BFD-RS is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).
- P is $1/(1- T_{SSB}/MGRP - T_{SSB}/T_{SMTCperiod})$, when BFD-RS is partially overlapped with measurement gap and BFD-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
    - $T_{SMTCperiod} \neq MGRP$ or
    - $T_{SMTCperiod} = MGRP$ and $T_{SSB} < 0.5*T_{SMTCperiod}$
- P is $1/(1- T_{SSB} /MGRP)* P_{sharing\ factor}$, when BFD-RS is partially overlapped with measurement gap and BFD-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod} = MGRP$ and $T_{SSB} = 0.5*T_{SMTCperiod}$
- P is $1/\{1- T_{SSB} /\min (T_{SMTCperiod} ,MGRP)\}$, when BFD-RS is partially overlapped with measurement gap ($T_{SSB} <MGRP$) and BFD-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.
- P is $1/(1- T_{SSB} /MGRP)* P_{sharing\ factor}$, when BFD-RS is partially overlapped with measurement gap and BFD-RS is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod} < MGRP$)
- $P_{sharing\ factor} = 3$.

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*.

Longer evaluation period would be expected if the combination of BFD-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

**Table 8.5.2.2-1: Evaluation period $T_{Evaluate\_BFD\_SSB}$ for FR1**

| Configuration | $T_{Evaluate\_BFD\_SSB}$ (ms) |
|---|---|
| no DRX | max([50], ceil(5*P)*$T_{SSB}$) |
| DRX cycle ≤ 320ms | max([50], ceil(7.5*P)*max($T_{DRX}$,$T_{SSB}$)) |
| DRX cycle > 320ms | ceil(5*P)*$T_{DRX}$ |
| Note: $T_{SSB}$ is the periodicity of SSB in the set $\overline{q}_0$. $T_{DRX}$ is the DRX cycle length. | |

**Table 8.5.2.2-2: Evaluation period $T_{Evaluate\_BFD\_out}$ for FR2**

| Configuration | $T_{Evaluate\_BFD\_SSB}$ (ms) |
|---|---|
| no DRX | max([50], ceil(5*P*N)*$T_{SSB}$) |
| DRX cycle ≤ 320ms | max([50], ceil(7.5*P*N)*max($T_{DRX}$,$T_{SSB}$)) |
| DRX cycle > 320ms | ceil(5*P*N)*$T_{DRX}$ |
| Note: $T_{SSB}$ is the periodicity of SSB in the set $\overline{q}_0$. $T_{DRX}$ is the DRX cycle length. | |

## 8.5.3 Requirements for CSI-RS based beam failure detection

### 8.5.3.1 Introduction

The requirements in this section apply for each CSI-RS resource in the set $\overline{q}_0$ configured for a serving cell, provided that the CSI-RS resource configured for beam failure detection are actually transmitted within the UE active DL BWP during the entire evaluation period specified in section 8.5.3.2. UE is not expected to perform beam failure detection measurements on the CSI-RS configured as BFD-RS if the CSI-RS is not QCL-ed with any CORESET configured in the UE active BWP.

**Table 8.5.3.1-1: PDCCH transmission parameters for beam failure instance**

| Attribute | Value for BLER |
|---|---|
| DCI format | 1-0 |
| Number of control OFDM symbols | 2 |
| Aggregation level (CCE) | 8 |
| Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | 0dB |
| Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | 0dB |
| Bandwidth (MHz) | TBD |
| Sub-carrier spacing (kHz) | TBD |
| DMRS precoder granularity | REG bundle size |
| REG bundle size | 6 |
| CP length | Normal |
| Mapping from REG to CCE | Distributed |

## 8.5.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured CSI-RS resource in set $\overline{q}_0$ estimated over the last $T_{Evaluate\_BFD\_CSI-RS}$ [ms] period becomes worse than the threshold $Q_{out\_LR\_CSI-RS}$ within $T_{Evaluate\_BFD\_CSI-RS}$ [ms] period.

The value of $T_{Evaluate\_BFD\_CSI-RS}$ is defined in Table 8.5.3.2-1 for FR1.

The value of $T_{Evaluate\_BFD\_CSI-RS}$ is defined in Table 8.5.3.2-2 for FR2 with

- N=1,
- the CSI-RS for BFD is QCL-TypeD with SSB for L1-RSRP beam reporting, and the CSI-RS for BFD and SSB for L1-RSRP beam reporting are TDM'd, and the CSI-RS for BFD is not in a resource set configured with repetition ON.

  Or

- the CSI-RS for BFD is QCL-TypeD with CSI-RS for L1-RSRP beam reporting with repetition parameter ON, and the CSI-RS for BFD and CSI-RS for L1-RSRP beam reporting are TDM'd, and the CSI-RS for BFD is not in a resource set configured with repetition ON.

  Editor's Note: It is FFS if N=1 can apply if the QCL-ed CSI-RS for L1-RSRP beam reporting is configured with repetition parameter "OFF".

- N=8, otherwise.

For FR1,

- P=1/(1 – $T_{CSI-RS}$/MGRP), when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and
- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P=1, when BFD-RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- P=1/(1 – $T_{CSI-RS}$/MGRP) , when BFD-RS is partially overlapped with measurement gap and BFD-RS is not overlapped with SMTC occasion ($T_{CSI-RS}$ < MGRP)
- P=1/(1 – $T_{CSI-RS}$ /$T_{SMTCperiod}$), when BFD-RS is not overlapped with measurement gap and BFD-RS is partially overlapped with SMTC occasion ($T_{CSI-RS}$ < $T_{SMTCperiod}$).

- P is $P_{sharing factor}$, when BFD-RS is not overlapped with measurement gap and BFD-RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).
- P is 1/(1- $T_{CSI-RS}$ /MGRP - $T_{CSI-RS}$ /$T_{SMTCperiod}$), when BFD-RS is partially overlapped with measurement gap and BFD-RS is partially overlapped with SMTC occasion (TCSI-RS < $T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq$ MGRP or
  - $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} < 0.5*T_{SMTCperiod}$
- P is 1/(1- $T_{CSI-RS}$ /MGRP)* $P_{sharing factor}$, when BFD-RS is partially overlapped with measurement gap and BFD-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} = 0.5*T_{SMTCperiod}$
- P is 1/{1- $T_{CSI-RS}$ /min ($T_{SMTCperiod}$ ,MGRP)}, when BFD-RS is partially overlapped with measurement gap ($T_{CSI-RS}$ < MGRP) and BFD-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.
- P is 1/(1- $T_{CSI-RS}$ /MGRP)* $P_{sharing factor}$, when BFD-RS is partially overlapped with measurement gap and BFD-RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)
- $P_{sharing factor}$ is 3**.**

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*.

*Editor's Note: FFS definition of overlap between CSI-RS for BFD-RS and SMTC*

Longer evaluation period would be expected if the combination of BFD-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

The values of $M_{BFD}$ used in Table 8.5.3.2-1 and Table 8.5.3.2-2 are defined as

- $M_{BFD}$ = 10, if the CSI-RS resource configured for BFD is transmitted with Density = 3.

**Table 8.5.3.2-1: Evaluation period $T_{Evaluate\_BFD\_CSI-RS}$ for FR1**

| Configuration | $T_{Evaluate\_BFD\_CSI-RS}$ (ms) |
|---|---|
| no DRX | max([50], [$M_{BFD}$ *P] * $T_{CSI-RS}$) |
| DRX cycle ≤ 320ms | max([50], [1.5×$M_{BFD}$ *P]*max($T_{DRX}$, $T_{CSI-RS}$)) |
| DRX cycle > 320ms | [$M_{BFD}$*P] * $T_{DRX}$ |
| Note: $T_{CSI-RS}$ is the periodicity of CSI-RS resource in the set $\overline{q}_0$. $T_{DRX}$ is the DRX cycle length. | |

**Table 8.5.3.2-2: Evaluation period $T_{Evaluate\_BFD\_CSI-RS}$ for FR2**

| Configuration | $T_{Evaluate\_BFD\_CSI-RS}$ (ms) |
|---|---|
| no DRX | max([50], [$M_{BFD}$ *P*N] * $T_{CSI-RS}$) |
| DRX cycle ≤ 320ms | max([50], [1.5×$M_{BFD}$*P*N]*max($T_{DRX}$, $T_{CSI-RS}$)) |
| DRX cycle > 320ms | [$M_{BFD}$ *P*N] * $T_{DRX}$ |
| Note: $T_{CSI-RS}$ is the periodicity of CSI-RS resource in the set $\overline{q}_0$. $T_{DRX}$ is the DRX cycle length. | |

## 8.5.4 Minimum requirement for L1 indication

When the radio link quality on all the configured RS resources in set $\overline{q}_0$ is worse than $Q_{out\_LR}$, Layer 1 of the UE shall send a beam failure instance indication to the higher layers. A Layer 3 filter may be applied to the beam failure instance indications as specified in [2].

The beam failure instance evaluation for the configured RS resources in set $\overline{q}_0$ shall be performed as specified in section 6 in [3]. Two successive indications from Layer 1 shall be separated by at least $T_{Indication\_interval\_BFD}$.

When DRX is not used, $T_{Indication\_interval\_BFD}$ is max(2ms, $T_{BFD-RS,M}$), where $T_{BFD-RS,M}$ is the shortest periodicity of all configured RS resources in set $\overline{q}_0$ for the accessed cell, corresponding to either the shortest periodicity of the SSB in the set $\overline{q}_0$ or CSI-RS resource in the set $\overline{q}_0$.

When DRX is used, $T_{Indication\_interval\_BFD}$ is max(1.5*DRX_cycle_length, 1.5*$T_{BFD-RS,M}$) if DRX cycle_length is less than or equal to 320ms, and $T_{Indication\_interval}$ is DRX_cycle_length if DRX cycle_length is greater than 320ms.

## 8.5.5 Requirements for SSB based candidate beam detection

### 8.5.5.1 Introduction

The requirements in this section apply for each SSB resource in the set $\overline{q}_1$ configured for a serving cell, provided that the SSBs configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in section 8.5.5.2.

### 8.5.5.2 Minimum requirement

UE shall be able to evaluate whether the L1-RSRP measured on the configured SSB resource in set $\overline{q}_1$ estimated over the last $T_{Evaluate\_CBD\_SSB}$ [ms] period becomes better than the threshold $Q_{in\_LR}$.

The value of $T_{Evaluate\_CBD\_SSB}$ is defined in Table 8.5.5.2-1 for FR1.

The value of $T_{Evaluate\_CBD\_SSB}$ is defined in Table 8.5.5.2-2 for FR2 with N=8.

Where,

For FR1,

- P=1/(1 – $T_{SSB}$/MGRP), when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB; and

- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- P=1/(1 – $T_{SSB}/T_{SMTCperiod}$), when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).

- P is 3, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).

- P is 1/(1- $T_{SSB}$/MGRP - $T_{SSB}/T_{SMTCperiod}$), when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and

  - $T_{SMTCperiod} \neq$ MGRP or

  - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5*T_{SMTCperiod}$

- P is 1/(1- $T_{SSB}$ /MGRP)*3, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5*T_{SMTCperiod}$

- P is 1/{1- $T_{SSB}$ /min ($T_{SMTCperiod}$ ,MGRP)}, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap

- P is 1/(1- $T_{SSB}$ /MGRP)*3, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)

[Longer evaluation period would be expected if the SSB is on the same OFDM symbols with RLM/BFD/BM-RS, or other CBD-RS, according to the measurement restrictions defined in section TBD.]

**Table 8.5.5.2-1: Evaluation period $T_{Evaluate\_CBD\_SSB}$ for FR1**

| Configuration | $T_{Evaluate\_CBD\_SSB}$ (ms) |
|---|---|
| non-DRX | ceil([3]*P) * $T_{SSB}$ |
| DRX cycle ≤ 320ms | ceil([3]*P*1.5) * max($T_{DRX}$,$T_{SSB}$) |
| DRX cycle > 320ms | ceil([3]*P) * $T_{DRX}$ |
| Note: $T_{SSB}$ is the periodicity of SSB in the set $\overline{q}_1$. $T_{DRX}$ is the DRX cycle length. | |

**Table 8.5.5.2-2: Evaluation period $T_{Evaluate\_CBD\_out}$ for FR2**

| Configuration | $T_{Evaluate\_CBD\_SSB}$ (ms) |
|---|---|
| non-DRX | ceil([3]*P*N) * $T_{SSB}$ |
| DRX cycle ≤ 320ms | ceil([3]*P*N*1.5) * max($T_{DRX}$,$T_{SSB}$) |
| DRX cycle > 320ms | ceil([3]*P*N) * $T_{DRX}$ |
| Note: $T_{SSB}$ is the periodicity of SSB in the set $\overline{q}_1$. $T_{DRX}$ is the DRX cycle length. | |

## 8.5.6 Requirements for CSI-RS based candidate beam detection

### 8.5.6.1 Introduction

The requirements in this section apply for each CSI-RS resource in the set $\overline{q}_1$ configured for a serving cell, provided that the CSI-RS resources configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in section 8.5.6.2.

### 8.5.6.2 Minimum requirement

UE shall be able to evaluate whether the L1-RSRP measured on the configured CSI-RS resource in set $\overline{q}_1$ estimated over the last $T_{Evaluate\_CBD\_CSI-RS}$ [ms] period becomes better than the threshold $Q_{in\_LR}$ within $T_{Evaluate\_CBD\_CSI-RS}$ [ms] period.

The value of $T_{Evaluate\_CBD\_CSI-RS}$ is defined in Table 8.5.6.2-1 for FR1.

The value of $T_{Evaluate\_CBD\_CSI-RS}$ is defined in Table 8.5.6.2-2 for FR2 with N=8.

Editor's Note: FFS whether N=1 need to be applied for CSI-RS based candidate beam detection in FR2.

For FR1,

- P=1/(1 – $T_{CSI-RS}$/MGRP), when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P=1, when candidate beam detection RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- P=1/(1 – $T_{CSI-RS}$/MGRP) , when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is not overlapped with SMTC occasion ($T_{CSI-RS}$ < MGRP)

- P=1/(1 – $T_{CSI-RS}$ /$T_{SMTCperiod}$), when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).

- P is 3, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).
- P is 1/(1- $T_{CSI-RS}$ /MGRP - $T_{CSI-RS}$ /$T_{SMTCperiod}$), when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion (TCSI-RS < $T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq$ MGRP or
  - $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} < 0.5*T_{SMTCperiod}$
- P is 1/(1- $T_{CSI-RS}$ /MGRP)* 3, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} = 0.5*T_{SMTCperiod}$
- P is 1/{1- $T_{CSI-RS}$ /min ($T_{SMTCperiod}$ ,MGRP)}, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap
- P is 1/(1- $T_{CSI-RS}$ /MGRP)* 3, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP) [Longer evaluation period would be expected if the CSI-RS is on the same OFDM symbols with RLM/BFD/BM-RS, or other CBD-RS, according to the measurement restrictions defined in section TBD.]

The values of $M_{CBD}$ used in Table 8.5.6.2-1 and Table 8.5.6.2-2 are defined as

- $M_{CBD}$ = 3, if the CSI-RS resource configured in the set $\overline{q}_1$ is transmitted with Density = 3.

**Table 8.5.6.2-1: Evaluation period $T_{Evaluate\_CBD\_CSI-RS}$ for FR1**

| Configuration | $T_{Evaluate\_CBD\_CSI-RS}$ (ms) |
|---|---|
| non-DRX | max(TBD, ceil($M_{CBD}$ *P) * $T_{CSI-RS}$) |
| DRX cycle ≤ 320ms | ceil($M_{CBD}$ *P*N) * max($T_{DRX}$, $T_{CSI-RS}$) |
| DRX cycle > 320ms | ceil($M_{CBD}$ *P) *$T_{DRX}$ |
| Note: $T_{CSI-RS}$ is the periodicity of CSI-RS resource in the set $\overline{q}_1$. $T_{DRX}$ is the DRX cycle length. | |

**Table 8.5.6.2-2: Evaluation period $T_{Evaluate\_CBD\_CSI-RS}$ for FR2**

| Configuration | $T_{Evaluate\_CBD\_CSI-RS}$ (ms) |
|---|---|
| non-DRX | max(TBD, ceil($M_{CBD}$ *P*N) * $T_{CSI-RS}$) |
| DRX cycle ≤ 320ms | ceil($M_{CBD}$ *P*N*1.5) * max($T_{DRX}$, $T_{CSI-RS}$) |
| DRX cycle > 320ms | ceil($M_{CBD}$ *P*N) *$T_{DRX}$ |
| Note: $T_{CSI-RS}$ is the periodicity of CSI-RS resource in the set $\overline{q}_1$. $T_{DRX}$ is the DRX cycle length. | |

## 8.5.7 Scheduling availability of UE during beam failure detection

Scheduling availability restrictions when the UE is performing beam failure detection are described in the following clauses.

### 8.5.7.1 Scheduling availability of UE performing beam failure detection with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to beam failure detection performed on SSB and CSI-RS configured as BFD-RS with the same SCS as PDSCH/PDCCH in FR1.

#### 8.5.7.2 Scheduling availability of UE performing beam failure detection with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to beam failure detection based on SSB as BFD-RS. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to beam failure detection based on SSB configured as BFD-RS.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured for beam failure detection.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions apply to all SCells that are aggregated in the same band as the PCell or PSCell. When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which PCell or PSCell is configured.

#### 8.5.7.3 Scheduling availability of UE performing beam failure detection on FR2

The following scheduling restriction applies due to beam failure detection.

When intra-band carrier aggregation is configured, the following scheduling restrictions apply to all SCells configured in the same band as the PCell and/or PSCell on which beam failure is detected.

- For the case where no RSs are provided for BFD, or where BFD-RS is explicitly configured and is QCLed with active TCI state for PDCCH/PDSCH, and N=1 applies for the BFD-RS as specified in section 8.5.2.2 if the BFD-RS is SSB and in section 8.5.3.2 if the BFD-RS is CSI-RS
    - There are no scheduling restrictions due to beam failure detection performed based on SSB or CSI-RS with a same SCS as PDSCH/PDCCH.
    - When performing beam failure detection based on SSB with a different SCS than PDSCH/PDCCH, for UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to beam failure detection. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured for beam failure detection.
- Otherwise
    - The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on BFD-RS symbols to be measured for beam failure detection.

When intra-band carrier aggregation is performed, the scheduling restrictions apply to all serving cells on the band due to beam failure detection performed on FR2 PCell or PSCell in the same band. When inter-band carrier aggregation within FR2 is performed, there are no scheduling restrictions on FR2 serving cell(s) in the bands due to beam failure detection performed on FR2 PCell or PSCell in different bands.

Editor's Note: FFS scheduling restrictions for inter-band carrier aggregation will be defined depending on band combination in future.

#### 8.5.7.4 Scheduling availability of UE performing beam failure detection on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to beam failure detection performed on FR2 serving PCell and/or PSCell.

There are no scheduling restrictions on FR2 serving cell(s) due to beam failure detection performed on FR1 serving PCell and/or PSCell.

### 8.5.8 Scheduling availability of UE during candidate beam detection

Scheduling availability restrictions when the UE is performing L1-RSRP measurement for candidate beam detection are described in the following clauses.

#### 8.5.8.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as link recovery detection resourcewith the same SCS as PDSCH/PDCCH in FR1.

#### 8.5.8.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as link recovery detection resource. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured as link recovery detection resource.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured for L1-RSRP.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions apply to all serving cells that are aggregated in the same band as the cell where L1-RSRP measurement is performed. When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands.

#### 8.5.8.3 Scheduling availability of UE performing L1-RSRP measurement on FR2

The following scheduling restriction applies due to beam failure detection

- For the case where no RSs are provided for beam failure detection, or where beam failure detection RS is explicitly configured and is QCLed with active TCI state for PDCCH/PDSCH, and N=1 applies for the beam failure detection RS as specified in section 8.5.2.2 if the beam failure detection RS is SSB and in section 8.5.3.2 if the beam failure detection RS is CSI-RS
  - There are no scheduling restrictions due to beam failure detection performed based on SSB or CSI-RS with a same SCS as PDSCH/PDCCH.
  - When performing beam failure detection based on SSB with a different SCS than PDSCH/PDCCH, for UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to beam failure detection. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on SSB symbols to be measured for beam failure detection.
  - The UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on BFD-RS symbols to be measured for beam failure detection.

When intra-band carrier aggregation is configured, the scheduling restrictions apply to all serving cells that are aggregated in the same band as the serving cell where L1-RSRP measurement for candidate beam detection is performed.

Editor's Note: FFS scheduling restrictions for inter-band carrier aggregation will be defined depending on band combination in future.

#### 8.5.8.4 Scheduling availability of UE performing L1-RSRP measurement on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to L1-RSRP measurement performed on FR2 serving cell(s).

There are no scheduling restrictions on FR2 serving cell(s) due to L1-RSRP measurement performed on FR1 serving cell(s).

# 8.6 Active BWP switch delay

## 8.6.1 Introduction

The requirements in this section apply for a UE configured with more than one BWP on PCell or any activated SCell in standalone NR, or PSCell or any activated SCell in SCG in EN-DC. UE shall complete the switch of active DL and/or UL BWP within the delay defined in this section.

## 8.6.2 DCI and timer based BWP switch delay

For DCI-based BWP switch, after the UE receives BWP switching request at slot n on a serving cell, UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch occurs no later than at slot n+ $T_{BWPswitchDelay}$.

For timer-based BWP switch, the UE shall start BWP switch at slot n, where n is the beginning of a subframe (FR1) or half-subframe (FR2) immediately after a BWP-inactivity timer *bwp-InactivityTimer* [2] expires on a serving cell, and the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch occurs no later than at slot n+ $T_{BWPswitchDelay}$.

The UE is not required to transmit UL signals or receive DL signals during time duration $T_{BWPswitchDelay}$ on the cell where DCI-based BWP switch or timer-based BWP switch occurs.

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in Table 8.6.2-1.

**Table 8.6.2-1: BWP switch delay**

| $\mu$ | NR Slot length (ms) | BWP switch delay $T_{BWPswitchDelay}$ (slots) | |
|---|---|---|---|
| | | Type 1[Note 1] | Type 2[Note 1] |
| 0 | 1 | [1] | [3] |
| 1 | 0.5 | [2] | [5] |
| 2 | 0.25 | [3] | [9] |
| 3 | 0.125 | [6] | [17] |
| Note 1: Depends on UE capability.<br>Note 2: If the BWP switch involves changing of SCS, the BWP switch delay is determined by the larger one between the SCS before BWP switch and the SCS after BWP switch. | | | |

*Editor's note: It is FFS if UL BWP switch delay should include the effect of the timing advance. If UE preparation time for UL BWP switch does not take into account of timing advance, the actual allowed UL BWP switch time will be shortened.*

## 8.6.3 RRC based BWP switch delay

For RRC-based BWP switch, after the UE receives BWP switching request, UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch occurs no later than at slot n+ $T_{RRCprocessingDelay}$ + $T_{BWPswitchDelayRRC}$, where slot n is the last slot containing the RRC command, and $T_{RRCprocessingDelay}$ is the length of the RRC procedure delay in slots defined in clause 12 in TS 38.331 [2], and $T_{BWPswitchDelayRRC}$ is the BWP switching delay for RRC based BWP switch.

*Editor's Note: $T_{BWPswitchDelayRRC}$ is going to be defined for both cases: 1) BWP switch to another already configured BWP; 2) BWP switch to a newly configured BWP in the same RRC re-configuration massage. FFS whether to define delay requirements for MAC based BWP switch. The UL grant uncertainty for transmitting RRCReconfigurationComplete due to TA and TA_offset during RRC based BWP switching is FFS.*

## 8.7 Void

# 9 Measurement Procedure

## 9.1 General measurement requirement

### 9.1.1 Introduction

This clause contains general requirements on the UE regarding measurement reporting in RRC_CONNECTED state. The requirements are split in intra-frequency, inter-frequency, inter-RAT E-UTRAN FDD, and inter-RAT E-UTRAN TDD requirements. These measurements may be used by the NG-RAN. The measurement quantities are defined in TS38.215[4], the measurement model is defined in TS38.300[10], TS37.340[17] and measurement accuracies are specified in clause 10. Control of measurement reporting is specified in [16].

In the requirements of Section 9, the exceptions for side conditions apply as follows:

- for the UE capable of CA but not configured with any SCell, the applicable exceptions for side conditions are specified in Annex B, Section B.3.2.1 for UE supporting CA in FR1, and Section B.3.2.3 for UE supporting CA in FR2, respectively;

- for the UE capable of CA and configured with at least one SCell, the applicable exceptions for side conditions are specified in Annex B, Section B.3.2.2 for UE configured with CA in FR1, and Section B.3.2.4 for UE supporting CA in FR2 respectively;

- for the UE capable of SUL but not configured with SUL, the applicable exceptions for side conditions are specified in Annex B, Section B.3.4.1 for UE supporting SUL in FR1;

- for the UE capable of SUL and configured with at least one SUL, the applicable exceptions for side conditions are specified in Annex B, Section B.3.4.2 for UE configured with SUL in FR1.

### 9.1.2 Measurement gap

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE does not support independent measurement gap patterns for different frequency ranges as specified in Table 5.1-1 in [18, 19, 20], in order for the requirements in the following subsections to apply the network must provide a single per-UE measurement gap pattern for concurrent monitoring of all frequency layers.

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports independent measurement gap patterns for different frequency ranges as specified in Table 5.1-1 in [18, 19, 20], in order for the requirements in the following subsections to apply the network must provide either per-FR measurement gap patterns for frequency range where UE requires per-FR measurement gap for concurrent monitoring of all frequency layers of each frequency range independently, or a single per-UE measurement gap pattern for concurrent monitoring of all frequency layers of all frequency ranges.

During the per-UE measurement gaps the UE:

- is not required to conduct reception/transmission from/to the corresponding E-UTRAN PCell, E-UTRAN SCell(s) and NR serving cells for NSA except the reception of signals used for RRM measurement

- is not required to conduct reception/transimssion from/to the corresponding NR serving cells for SA except the reception of signals used for RRM measurement

During the per-FR measurement gaps the UE:

- is not required to conduct reception/transmission from/to the corresponding E-UTRAN PCell, E-UTRAN SCell(s) and NR serving cells in the corresponding frequency range for NSA except the reception of signals used for RRM measurement

- is not required to conduct reception/transmission from/to the corresponding NR serving cells in the corresponding frequency range for SA except the reception of signals used for RRM measurement

UEs shall support the measurement gap patterns listed in Table 9.1.2-1 based on the applicability specified in table 9.1.2-2 and 9.1.2-3. UE determines measurement gap timing based on gap offset configuration and measurement gap timing advance configuration provided by higher layer signalling as specified in [2] and [16].

**Table 9.1.2-1: Gap Pattern Configurations**

| Gap Pattern Id | Measurement Gap Length (MGL, ms) | Measurement Gap Repetition Period (MGRP, ms) |
|---|---|---|
| 0 | 6 | 40 |
| 1 | 6 | 80 |
| 2 | 3 | 40 |
| 3 | 3 | 80 |
| 4 | 6 | 20 |
| 5 | 6 | 160 |
| 6 | 4 | 20 |
| 7 | 4 | 40 |
| 8 | 4 | 80 |
| 9 | 4 | 160 |
| 10 | 3 | 20 |
| 11 | 3 | 160 |
| 12 | 5.5 | 20 |
| 13 | 5.5 | 40 |
| 14 | 5.5 | 80 |
| 15 | 5.5 | 160 |
| 16 | 3.5 | 20 |
| 17 | 3.5 | 40 |
| 18 | 3.5 | 80 |
| 19 | 3.5 | 160 |
| 20 | 1.5 | 20 |
| 21 | 1.5 | 40 |
| 22 | 1.5 | 80 |
| 23 | 1.5 | 160 |

**Table 9.1.2-2: Applicability for Gap Pattern Configurations supported by the E-UTRA-NR dual connectivity UE**

| Measurement gap pattern configuration | Serving cell | Measurement Purpose | Applicable Gap Pattern Id |
|---|---|---|---|
| Per-UE measurement gap | E-UTRA + FR1, or E-UTRA + FR2, or E-UTRA + FR1 + FR2 | non-NR RAT [Note1,2] | 0,1,2,3 |
| | | FR1 and/or FR2 | 0-11 |
| | | non-NR RAT[Note1,2] and FR1 and/or FR2 | 0, 1, 2, 3, 4, 6, 7, 8,10 |
| Per FR measurement gap | E-UTRA and, FR1 if configured | non-NR RAT [Note1,2] | 0,1,2,3 |
| | FR2 if configured | | No gap |
| | E-UTRA and, FR1 if configured | FR1 only | 0-11 |
| | FR2 if configured | | No gap |
| | E-UTRA and, FR1 if configured | FR2 only | No gap |
| | FR2 if configured | | 12-23 |
| | E-UTRA and, FR1 if configured | non-NR RAT [Note1,2] and FR1 | 0, 1, 2, 3, 4, 6, 7, 8,10 |
| | FR2 if configured | | No gap |
| | E-UTRA and, FR1 if configured | FR1 and FR2 | 0-11 |
| | FR2 if configured | | 12-23 |
| | E-UTRA and, FR1 if configured | non-NR RAT [Note1,2] and FR2 | 0, 1, 2, 3, 4, 6, 7, 8,10 |
| | FR2 if configured | | 12-23 |

| | | | |
|---|---|---|---|
| | E-UTRA and, FR1 if configured | non-NR RAT [Note1,2] and FR1 and FR2 | 0, 1, 2, 3, 4, 6, 7, 8,10 |
| | FR2 if configured | | 12-23 |

*Note: if GSM or UTRA TDD or UTRA FDD inter-RAT frequency layer is configured to be monitered, only measurement gap pattern #0 and #1 can be used for per-FR gap in E-UTRA and FR1 if configured, or for per-UE gap.*

NOTE 1: Non-NR RAT includes E-UTRA, UTRA and/or GSM.

NOTE 2: The gap patterns with short MGL (gap pattern #2, 3, 6, 7, 8, 10) are supported by UEs which support shortMeasurementGap-r14.

NOTE 3: When E-UTRA inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, only Gap Pattern #0 can be used.

NOTE4: If per-UE measurement gap is configured with MG timing advance of $T_{MG}$ ms, the measurement gap starts at time $T_{MG}$ ms advanced to the end of the latest E-UTRA subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.
If per-FR measurenet gap for FR1 is configured with MG timing advance of $T_{MG}$ ms, the measurement gap for FR1 starts at time $T_{MG}$ ms advanced to the end of the latest E-UTRA subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.
If per-FR measurenet gap for FR2 is configured with MG timing advance of $T_{MG}$ ms, the measurement gap for FR2 starts at time $T_{MG}$ ms advanced to the end of the latest NR subframe occurring immediately before the configured measurement gap among SCG serving cells subframes in FR2.
$T_{MG}$ is the MG timing advance value provided in *mgta* according to [2].
In determining the measurement gap starting point, UE shall use the DL timing of the latest E-UTRA or NR subframe occurring immediately before the configured measurement gap among E-UTRA or NR serving cells.

For per-FR measurement gap capable UE configured with E-UTRA-NR dual connectivity, when serving cells are in E-UTRA and FR1, measurement objects are in both E-UTRA /FR1 and FR2,

- If MN indicates UE that the measurement gap from MN applies to E-UTRA/FR1/FR2 serving cells, UE fulfils the per-UE measurement requirements for both E-UTRA/FR1 and FR2 measurement objects based on the measurement gap pattern configured by MN;

- If MN indicates UE that the measurement gap from MN applies to only LTE/FR1 serving cell(s),

  - UE fulfils the measurement requirements for FR1/LTE measurement objects based on the configured measurement gap pattern;

  - UE fulfils the requirements for FR2 measurement objects based on effective MGRP=20ms;

For per-FR measurement gap capable UE, when serving cells are in E-UTRA, FR1 and FR2, or in E-UTRA and FR2, measurement objects are in both E-UTRA /FR1 and FR2,

- If MN indicates UE that the measurement gap from MN applies to E-UTRA/FR1/FR2 serving cells, UE fulfils the per-UE measurement requirements for both E-UTRA/FR1 and FR2 measurement objects based on the measurement gap pattern configured by MN.

**Table 9.1.2-3: Applicability for Gap Pattern Configurations supported by the UE with NR standalone operation**

| Measurement gap pattern configuration | Serving cell | Measurement Purpose [NOTE 2] | Applicable Gap Pattern Id |
|---|---|---|---|
| Per-UE measurement gap | FR1, or FR1 + FR2 | E-UTRA only [NOTE3] | 0,1,2,3 |
| | | FR1 and/or FR2 | 0-11 |
| | | E-UTRAN and FR1 and/or FR2 [NOTE3] | 0, 1, 2, 3, 4, 6, 7, 8,10 |
| | FR2 | E-UTRA only [NOTE3] | 0,1,2,3 |
| | | FR1 only | 0-11 |
| | | FR1 and FR2 | 0-11 |

| | | | |
|---|---|---|---|
| | | E-UTRAN and FR1 and/or FR2 NOTE3 | 0, 1, 2, 3, 4, 6, 7, 8,10 |
| | | FR2 only | 12-23 |
| Per FR measurement gap | FR1 if configured | E-UTRA only NOTE3 | 0,1,2,3 |
| | FR2 if configured | | No gap |
| | FR1 if configured | FR1 only | 0-11 |
| | FR2 if configured | | No gap |
| | FR1 if configured | FR2 only | No gap |
| | FR2 if configured | | 12-23 |
| | FR1 if configured | E-UTRA and FR1 NOTE3 | 0, 1, 2, 3, 4, 6, 7, 8,10 |
| | FR2 if configured | | No gap |
| | FR1 if configured | FR1 and FR2 | 0-11 |
| | FR2 if configured | | 12-23 |
| | FR1 if configured | E-UTRA and FR2 NOTE3 | 0, 1, 2, 3, 4, 6, 7, 8,10 |
| | FR2 if configured | | 12-23 |
| | FR1 if configured | E-UTRA and FR1 and FR2 NOTE3 | 0, 1, 2, 3, 4, 6, 7, 8,10 |
| | FR2 if configured | | 12-23 |

NOTE 1: When E-UTRA inter-RAT RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, only Gap Pattern #0 can be used.

NOTE 2: Measurement purpose which includes E-UTRA measurements includes also inter-RAT E-UTRA RSRP and RSRQ measurements for E-CID

NOTE 3: The measurement gap pattern #2, 3, 6, 7, 8, 10 are supported by the UEs which indicate the capability signalling of supportedGapPattern to network.

NOTE4: If per-UE measurement gap is configured with MG timing advance of $T_{MG}$ ms, the measurement gap starts at time $T_{MG}$ ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among all serving cells subframes.
If per-FR measurenet gap for FR1 is configured with MG timing advance of $T_{MG}$ ms, the measurement gap for FR1 starts at time $T_{MG}$ ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among serving cells subframes in FR1.
If per-FR measurenet gap for FR2 is configured with MG timing advance of $T_{MG}$ ms, the measurement gap for FR2 starts at time $T_{MG}$ ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among serving cells subframes in FR2.
$T_{MG}$ is the MG timing advance value provided in *mgta* according to [2].
In determining the measurement gap starting point, UE shall use the DL timing of the latest subframe occurring immediately before the configured measurement gap among serving cells.

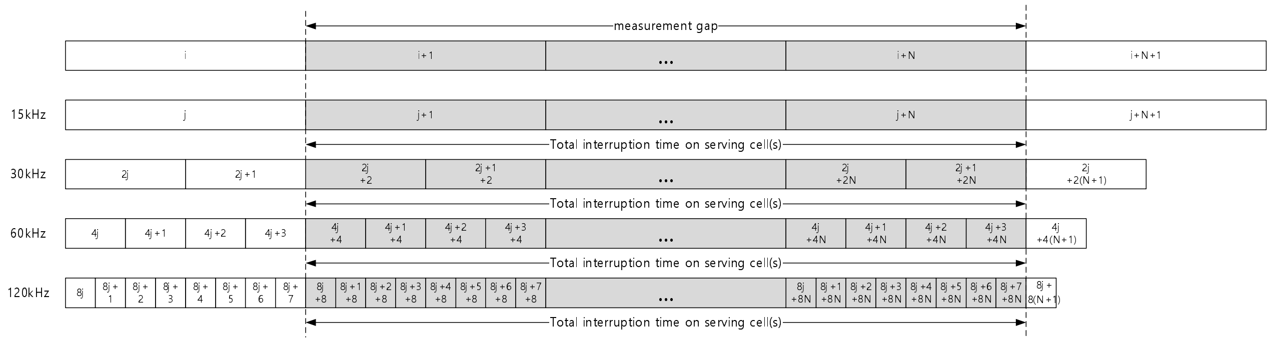
For per-FR measurement gap capable UE in NR standalone operation, for per-FR gap based measurement,when there is no serving cell in a particular FR, where measurements objects are configured, regardless if explicit per-FR measurement gap is configured in this FR, the effective MGRP in this FR used to determine requirements;

- 20ms for FR2 NR measurements
- 40ms for FR1 NR measurements
- 40ms for LTE measurements
- 40ms for FR1+LTE measurements

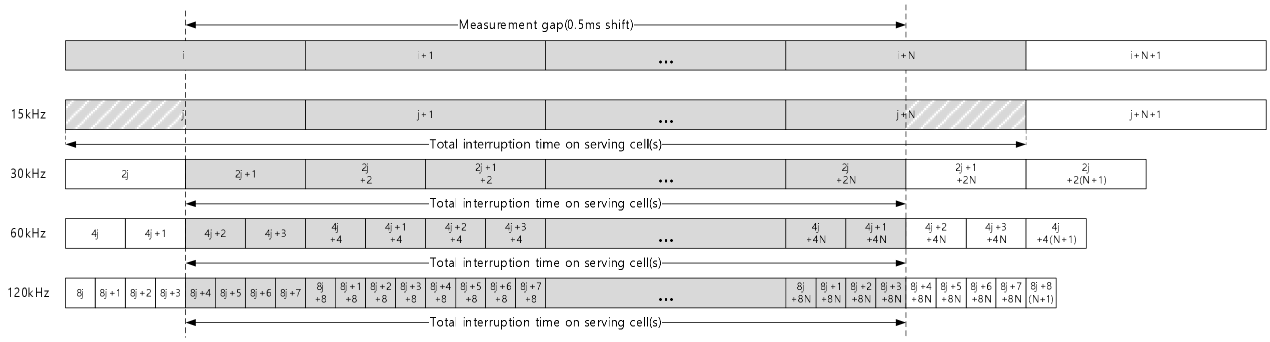
If measurement gap is configured in one FR but measurement object is not configured in the FR, the scheduling opportunity in the FR depends on the configured measurement gap pattern.

For E-UTRA-NR dual connectivity, if UE is not capable of per-FR-gap, total interruption time on SCG during MGL is defined only when MGL(N) = 6ms, 4ms and 3ms. And if UE is capable of per-FR-gap, total interruption time on FR1 serving cells in SCG during MGL is defined only when MGL(N) = 6ms, 4ms and 3ms, and total interruption time on FR2 serving cells in SCG during MGL is defined only when MGL(N) = 5.5ms, 3.5ms and 1.5ms, given that the reference time for per-FR gap in FR2 is based on an FR2 serving cell.

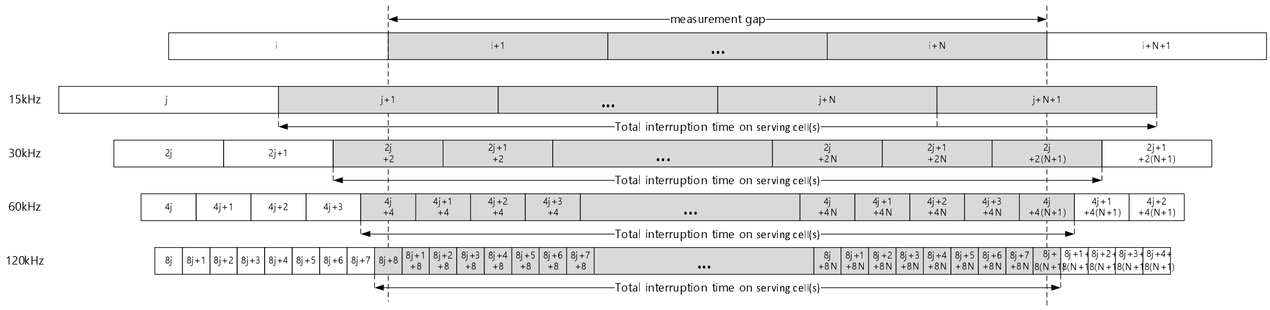
For NR standalone, if UE is not capable of per-FR-gap, total interruption time on a serving cell during MGL is defined only when MGL(N) = 6ms, 4ms and 3ms. And if UE is capable of per-FR-gap, total interruption time on FR1 serving cells during MGL is defined only when MGL(N) = 6ms, 4ms and 3ms, and total interruption time on FR2 serving cells during MGL is defined only when MGL(N) = 5.5ms, 3.5ms and 1.5ms, given that the reference time for per-FR gap in FR2 is based on an FR2 serving cell.



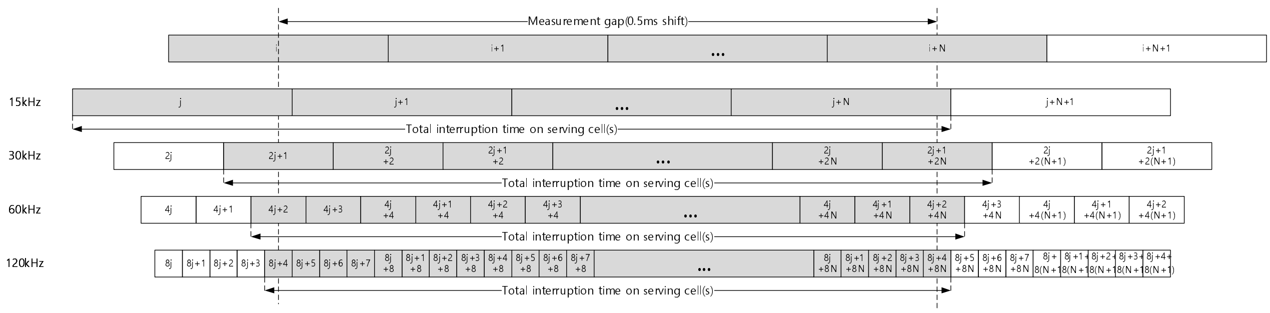

(a) Measurement gap with MGL = N(ms) with MG timing advance of 0ms for synchronous EN-DC and NR standalone




(b) Measurement gap with MGL = N(ms) with MG timing advance of 0.5ms for synchronous EN-DC and NR standalone




(c) Measurement gap with MGL = N(ms) with MG timing advance of 0ms for asynchronous EN-DC




(d) Measurement gap with MGL = N(ms) with MG timing advance of 0.5ms for asynchronous EN-DC

**Figure 9.1.2-1: Measurement GAP and total interruption time on serving cells for EN-DC and NR standalone**

The corresponding total number of interrupted slots on serving cells is listed in Table9.1.2-4 and Table9.1.2-4a for synchronous EN-DC and NR standalone, and asynchronous EN-DC respectively.

**Table 9.1.2-4: Total number of interrupted slots on serving cells during MGL for Synchronous EN-DC and NR standalone with per-UE measurement gap or per-FR measurement gap for FR1**

| NR SCS (kHz) | Total number of interrupted slots on serving cells | | | | | |
|---|---|---|---|---|---|---|
| | When MG timing advance of 0ms is applied | | | When MG timing advance of 0.5ms is applied | | |
| | MGL=6ms | MGL=4ms | MGL=3ms | MGL=6ms | MGL=4ms | MGL=3ms |
| 15 | 6 | 4 | 3 | 7[Note3] | 5[Note3] | 4[Note3] |
| 30 | 12 | 8 | 6 | 12 | 8 | 6 |
| 60 | 24 | 16 | 12 | 24 | 16 | 12 |
| 120 | 48 | 32 | 24 | 48 | 32 | 24 |

NOTE 1: For Gap Pattern ID 0, 1, 2 and 3, total number of interrupted subframes on MCG is MGL subframes when MG timing advance of 0ms is applied, and (MGL+1) subframes when MG timing advance of 0.5ms is applied.
NOTE 2: NR SCS of 120 kHz is only applicable to the case with per-UE measurement gap.
NOTE 3: Non-overlapped half-slots occur before and after the measurement gap. Whether a Rel-15 UE can receive and/or transmit in those half-slots is up to UE implementation.

**Table 9.1.2-4a: Total number of interrupted slots on serving cells during MGL for Asynchronous EN-DC with per-UE measurement gap or per-FR measurement gap for FR1**

| NR SCS (kHz) | Total number of interrupted slots on serving cells | | | | | |
|---|---|---|---|---|---|---|
| | When MG timing advance of 0ms is applied | | | When MG timing advance of 0.5ms is applied | | |
| | MGL=6ms | MGL=4ms | MGL=3ms | MGL=6ms | MGL=4ms | MGL=3ms |
| 15 | 7 | 5 | 4 | 7 | 5 | 4 |
| 30 | 13 | 9 | 7 | 13 | 9 | 7 |
| 60 | 25 | 17 | 13 | 25 | 17 | 13 |
| 120 | 49 | 33 | 25 | 49 | 33 | 25 |

NOTE 1: For Gap Pattern ID 0, 1, 2 and 3, total number of interrupted subframes on MCG is MGL subframes when MG timing advance of 0ms is applied, and (MGL+1) subframes when MG timing advance of 0.5ms is applied.
NOTE 2: NR SCS of 120 kHz is only applicable to the case with per-UE measurement gap.

In case that UE capable of per-FR measurement gap is configured with per-FR measurement gap for FR2 serving cells, total number of interrupted slots on FR2 serving cells during MGL is listed in Table9.1.2-4b.

**Table 9.1.2-4b: Total number of interrupted slots on FR2 serving cells during MGL for EN-DC and NR standalone with per-FR measurement gap for FR2**

| NR SCS (kHz) | Total number of interrupted slots on FR2 serving cells | | | | | |
|---|---|---|---|---|---|---|
| | When MG timing advance of 0ms is applied | | | When MG timing advance of 0.25ms is applied | | |
| | MGL=5.5ms | MGL=3.5ms | MGL=1.5ms | MGL=5.5ms | MGL=3.5ms | MGL=1.5ms |
| 60 | 22 | 14 | 6 | 22 | 14 | 6 |
| 120 | 44 | 28 | 12 | 44 | 28 | 12 |

In the slot occurring immediately after measurement gap and fully non-overlapped with measurement gap

- It is up to UE implementation whether or not the UE is able to conduct transmission if all the symbols in the slot are uplink symbols.

Editor notes: FFS if very large TA is applied.

**Table 9.1.2-5: (Void)**

### 9.1.2.1 NSA: Measurement Gap Sharing

For E-UTRA-NR dual connectivity UE configured with per-UE measurement gap, measurement gap sharing shall be applies when UE requires measurement gaps to identify and measure cells on intra-frequency carriers or when SMTC configured for intra-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE is configured to identify and measure cells on inter-frequency carriers, E-UTRA gap-needed inter-frequency carriers and inter-RAT UTRAN carriers and/or inter-RAT GSM carriers.

For E-UTRA-NR dual connectivity UE configured with per-FR1 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR1 intra-frequency carriers or when SMTC configured for FR1 intra-frequency measurement are fully overlapping with per-FR1 measurement gaps, and when UE is configured to identify and measure cells on FR1 inter-frequency carriers, E-UTRA gap-needed inter-frequency carriers, inter-RAT UTRAN carriers and/or inter-RAT GSM carriers.

For E-UTRA-NR dual connectivity UE configured with per-FR2 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR2 intra-frequency carriers or when SMTC configured for FR2 intra-frequency measurement are fully overlapping with per-FR2 measurement gaps, and when UE is configured to identify and measure cells on FR2 inter-frequency carriers.

When network signals “01”, “10” or “11”, where X is a signalled RRC parameter *measGapSharingConfig* [2][16]and is defined as in Table 9.1.2-5,

- the performance of intra-frequency measurements with no measurement gaps as specified in section 9.2.5, when SMTC configured for intra-frequency measurement are fully overlapping with measurement gaps, shall consider the factor $K_{intra} = 1 / X * 100$,

- the performance of intra-frequency measurements with measurement gaps as specified in section 9.2.6 shall consider the factor $K_{intra} = 1 / X * 100$,

- the performance of inter-frequency measurement as specified in section 9.3 and the performance of inter-RAT measurement as specified in section 9.4 shall consider the factor $K_{inter} = 1 / (100 – X) * 100$,

When network signals “00” indicating equal splitting gap sharing, X is not applied and the performance of intra-frequency measurements as specified in section 9.2.5 and section 9.2.6, the performance of inter-frequency measurement as specified in section 9.3 and the performance of inter-RAT measurement as specified in section 9.4 are FFS.

**Table 9.1.2.1-1: Value of parameter X for EN-DC measurement gap sharing**

| ***measGapSharingConfig*** | **Value of X (%)** |
|---|---|
| ‘00’ | Equal splitting |
| ‘01’ | 25 |
| ‘10’ | 50 |
| ‘11’ | 75 |

### 9.1.2.1a SA: Measurement Gap Sharing

For NR standalone UE configured with per-UE measurement gap, measurement gap sharing shall be applies when UE requires measurement gaps to identify and measure cells on intra-frequency carriers or when SMTC configured for intra-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE is configured to identify and measure cells on inter-frequency carriers, and/or inter-RAT E-UTRAN carriers.

For NR standalone UE configured with per-FR1 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR1 intra-frequency carriers or when SMTC configured for FR1 intra-frequency measurement are fully overlapping with per-FR1 measurement gaps, and when UE is configured to identify and measure cells on FR1 inter-frequency carriers and/or inter-RAT E-UTRAN carriers.

For NR standalone UE configured with per-FR2 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR2 intra-frequency carriers or when SMTC configured for FR2 intra-frequency measurement are fully overlapping with per-FR2 measurement gaps, and when UE is configured to identify and measure cells on FR2 inter-frequency carriers.

When network signals “01”, “10” or “11”, where X is a signalled RRC parameter *measGapSharingConfig* [2] and is defined as in Table 9.1.2-5,

- the performance of intra-frequency measurements with no measurement gaps as specified in section 9.2.5, when SMTC configured for intra-frequency measurement are fully overlapping with measurement gaps, shall consider the factor $K_{intra} = 1 / X * 100$,

- the performance of intra-frequency measurements with measurement gaps as specified in section 9.2.6 shall consider the factor $K_{intra} = 1 / X * 100$,

- the performance of inter-frequency measurement as specified in section 9.3 and the performance of inter-RAT measurement as specified in section 9.4 shall consider the factor $K_{inter} = 1 / (100 – X) * 100$,

When network signals "00" indicating equal splitting gap sharing, X is not applied and the performance of intra-frequency measurements as specified in section 9.2.5 and section 9.2.6, the performance of inter-frequency measurement as specified in section 9.3 and the performance of inter-RAT measurement as specified in section 9.4 are FFS.

**Table 9.1.2.1a-1: Value of parameter X for NR standalone measurement gap sharing**

| ***measGapSharingConfig*** | **Value of X (%)** |
|---|---|
| '00' | Equal splitting |
| '01' | 25 |
| '10' | 50 |
| '11' | 75 |

## 9.1.3 UE Measurement capability

### 9.1.3.1 NSA: Monitoring of multiple layers using gaps

The requirements in this section are applicable for UE capable of E-UTRA-NR dual connectivity operation with E-UTRA PCell.

When monitoring of multiple inter-frequency E-UTRAN, inter-RAT NR, GSM, UTRA FDD and UTRA TDD carriers as configured by E-UTRA PCell, and inter-frequency NR carriers as configured by PSCell using gaps (or without using gaps provided the UE supports such capability) is configured, the UE shall be capable of performing one measurement of the configured measurement type (SS-RSRP, SS-RSRQ, SS-SINR, SFTD, E-UTRAN RSRP, E-UTRAN RSRQ, E-UTRAN RS-SINR measurements, UTRAN TDD P-CCPCH RSCP, UTRAN FDD CPICH measurements, GSM carrier RSSI, etc.) of detected cells on all the layers.

For UE configured with the E-UTRA-NR dual connectivity operation, the effective total number of frequencies excluding the frequencies of the PSCell, SCells, E-UTRA PCell, and E-UTRA SCells being monitored is $N_{freq, NSA}$, which is defined as:

$N_{freq, NSA} = N_{freq, NSA, NR} + N_{freq, NSA, E\text{-}UTRA} + N_{freq, NSA, UTRA} + M_{NSA, GSM}$,

where

$N_{freq, NSA, E\text{-}UTRA}$ is the number of E-UTRA inter-frequency carriers being monitored (FDD and TDD) as configured by E-UTRA PCell or via LPP [22].

$N_{freq, NSA, NR} \le N_{freq, NSA, NR, inter\text{-}RAT} + N_{freq, NSA, NR, inter\text{-}freq}$

where

$N_{freq, NSA, NR, inter\text{-}RAT}$ is the number of NR inter-RAT carriers excluding NR serving carrier(s) being monitored as configured by E-UTRA PCell [15]

$N_{freq, NSA, NR, inter\text{-}freq}$ is the number of NR inter-frequency carriers being monitored as configured by PSCell

$N_{freq, NSA, UTRA}$ is the number of UTRA inter-RAT carriers being monitored as configured by E-UTRA PCell (FDD and TDD)

$M_{NSA, GSM}$ is an integer which is a function of the number of GSM inter-RAT carriers as configured by E-UTRA PCell on which measurements are being performed. $M_{NSA, GSM}$ is equal to 0 if no GSM carrier is being monitored. For a MGRP of 40 ms, $M_{NSA, GSM}$ is equal to 1 if cells on up to 32 GSM carriers are being measured. For a MGRP of 80 ms, $M_{NSA, GSM}$ is equal to ceil($N_{carriers,GSM}$ /20) where $N_{carriers,GSM}$ is the number of GSM carriers on which cells are being measured.

### 9.1.3.1a SA: Monitoring of multiple layers using gaps

The requirements in this section are applicable for UE configured with at least a PCell.

When monitoring of multiple inter-RAT E-UTRAN carriers and inter-frequency NR carriers using gaps (or without using gaps provided the UE supports such capability) is configured by PCell, the UE shall be capable of performing one measurement of the configured measurement type (SS-RSRP, SS-RSRQ, SS-SINR, E-UTRAN RSRP, E-UTRAN RSRQ, E-UTRAN RS-SINR measurements, etc.) of detected cells on all the layers.

For UE configured with the NR SA operation, the effective total number of frequencies, excluding the frequencies of the PCell, PSCell and SCells being monitored, is $N_{freq, SA}$, which is defined as:

$N_{freq, SA} = N_{freq, SA, NR} + N_{freq, SA, E\text{-}UTRA}$,

where

$N_{freq, SA, E\text{-}UTRA}$ is the number of E-UTRA inter-RAT carriers being monitored (FDD and TDD) as configured by PCell or via LPP [22].

$N_{freq, SA, NR}$ is the number of NR inter-frequency carriers being monitored as configured by PCell.

### 9.1.3.2 NSA: Maximum allowed layers for multiple monitoring

If a UE is configured with E-UTRA-NR dual connectivity operation, the UE shall be capable of monitoring at least:

- Depending on UE capability, 7 NR inter-frequency carriers configured by PScell, and
- Depending on UE capability, 7 NR inter-RAT carriers excluding NR serving carrier(s) configured by E-UTRA PCell [15], and
- Depending on UE capability, 6 E-UTRA TDD inter-frequency carriers configured by E-UTRA PCell [15], and
- Depending on UE capability, 6 E-UTRA FDD inter-frequency carriers configured by E-UTRA PCell [15], and
- Depending on UE capability, 3 FDD UTRA carriers, and
- Depending on UE capability, 3 TDD UTRA carriers, and
- Depending on UE capability, 32 GSM carriers (one GSM layer corresponds to 32 carriers), and
- Depending on UE capability, 1 E-UTRA FDD inter-frequency carrier for RSTD measurements configured via LPP [22], and
- Depending on UE capability, 1 E-UTRA TDD inter-frequency carrier for RSTD measurements configured via LPP [22].

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 13 effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD and GSM (one GSM layer corresponds to 32 carriers) layers. The UE shall be capable of monitoring a total of at least 7 effective NR carrier frequency layers excluding NR serving carrier(s), comprising of any above defined combination of NR inter-RAT carriers excluding NR serving carrier(s) configured by E-UTRA PCell and NR inter-frequency carriers configured by PSCell.

When the E-UTRA PCell and PSCell configure the same NR carrier frequency layer to be monitored by the UE in synchronous intra-band EN-DC, this layer shall be counted only once to the total number of effective carrier frequency layers provided that the SFN-s and slot boundries are aligned, unless the configured NR carrier frequency layers to be monitored have

- different subcarrier spacing or
- different RSSI measurement resources or
- different deriveSSB-IndexFromCell indications or

- different SMTC configurations.

Note 1: The E-UTRA-NR dual connectivity capable UE configured with PSCell shall fulfil the requirements defined in only one of Section 9.1.3.2 and Section 8.1.2.1.1b.1 of [15].

NOTE 2: Void

*Editor's note: FFS when the E-UTRA PCell and PSCell configure the same NR carrier frequency layer to be monitored, whether this layer shall be counted only once under the condition that the UE is configured with differences in SMTC configurations or different useServingCellTimingForSync indications.*

#### 9.1.3.2a SA: Maximum allowed layers for multiple monitoring

If a UE is configured with at least a PCell, the UE shall be capable of monitoring at least:

- Depending on UE capability, 7 NR inter-frequency carriers configured by PCell, and
- Depending on UE capability, 7 E-UTRA TDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 7 E-UTRA FDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 1 E-UTRA FDD inter-RAT carrier for RSTD measurements configured via LPP [22], and
- Depending on UE capability, 1 E-UTRA TDD inter-RAT carrier for RSTD measurements configured via LPP [22].

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least [13] effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD and E-UTRA TDD layers.

### 9.1.4 Capabilities for Support of Event Triggering and Reporting Criteria

#### 9.1.4.1 Introduction

This clause contains requirements on UE capabilities for support of event triggering and reporting criteria. As long as the measurement configuration does not exceed the requirements stated in Section 9.1.4.2, the UE shall meet all other performance requirements defined in Section 9 and Section 10.

The UE can be requested to make measurements under different measurement identities defined in TS 38.331 [2]. Each measurement identity corresponds to either event based reporting, periodic reporting, or no reporting. In case of event based reporting, each measurement identity is associated with an event triggering criterion. In case of periodic reporting, a measurement identity is associated with one periodic reporting criterion. In case of no reporting, a measurement identity is associated with one no reporting criterion.

The purpose of this clause is to set some limits on the number of different event triggering, periodic, and no reporting criteria the UE may be requested to track in parallel.

#### 9.1.4.2 Requirements

In this section a reporting criterion corresponds to either one event (in the case of event based reporting), or one periodic reporting criterion (in case of periodic reporting), or one no reporting criterion (in case of no reporting). For event based reporting, each instance of event, with the same or different event identities, is counted as separate reporting criterion in Table 9.1.4.2-1.

The UE shall be able to support in parallel per category up to $E_{cat}$ reporting criteria according to Table 9.1.4.2-1. For the measurement categories belonging to intra-frequency, inter-frequency, and inter-RAT measurements (i.e. without counting other categories that the UE shall always support in parallel), the UE need not support more than the total number of reporting criteria as follows:

- For UE configured with EN-DC: $E_{cat,NSA,NR} + E_{cat,NSA,E-UTRA}$, where

  $E_{cat,NSA,NR} = 10 + 9 \times n$ is the total number of NR reporting criteriaapplicable for UE configured with EN-DC according to Table 9.1.4.2-1, and $n$ is the number of configured NR serving frequencies, including PSCell and SCells carrier frequencies,

$E_{cat,NSA,E-UTRA}$ is the total number of reporting criteria for E-UTRA PCell as specified in TS 36.133 [15] for UE configured with EN-DC,

- For UE not configured of EN-DC: $E_{cat,SA,NR} + E_{cat,SA,E-UTRA}$ , where

  $E_{cat,SA,NR} = 10 + 9 \times n$ is the total number of NR reporting criteria according to Table 9.1.4.2-1, and $n$ is the number of configured NR serving frequencies, including PCell and SCells carrier frequencies,

  $E_{cat,SA,E-UTRA}$ is the total number of E-UTRA inter-RAT reporting criteria according to Table 9.1.4.2-1.

**Table 9.1.4.2-1: Requirements for reporting criteria per measurement category**

| Measurement category | $E_{cat}$ | Note |
|---|---|---|
| Intra-frequency Note 1 | 9 | Events for any one or a combination of intra-frequency SS-RSRP, SS-RSRQ, and SS-SINR for NG-RAN intra-frequency cells |
| Inter-frequency | 10 | Events for any one or a combination of inter-frequency SS-RSRP, SS-RSRQ, and SS-SINR for NG-RAN inter-frequency cells |
| Inter-RAT (E-UTRA FDD, E-UTRA TDD) | 10 | Only applicable for UE with this (inter-RAT) capability when the UE is not configured with EN-DC operation. |
| Inter-RAT (E-UTRA FDD, E-UTRA TDD) RSTD | 1 | Inter-RAT RSTD measurement reporting for UE supporting OTDOA; 1 report capable of minimum 16 inter-RAT cell measurements. Only applicable for UE with this (inter-RAT RSTD via LPP [22]) capability and when the UE is not configured with EN-DC operation. |
| Inter-RAT (E-UTRA FDD, E-UTRA TDD) RSRP and RSRQ measurements for E-CID | 1 | Inter-RAT RSRP and RSRQ measurements for E-CID reported to E-SMLC via LPP [22]. One report capable of at least in total 10 inter-RAT RSRP and RSRQ measurements. Applicable to UE capable of reporting inter-RAT RSRP and RSRQ to E-SMLC via LPP and when the UE is not configured with EN-DC operation. |
| NOTE 1: When the UE is configured with PSCell and SCell carrier frequencies, $E_{cat}$ for Intra-frequency is applied per serving frequency. | | |

## 9.1.5 Carrier-specific scaling factor

This clause specifies the derivation of carrier-specific scaling factor (CSSF) values, which scale the measurement delay requirements given in Section 9.2, 9.3 and 9.4 when UE is configured to monitor multiple measurement objects. The CSSF values are categorized into $CSSF_{outside\_gap,i}$ and $CSSF_{within\_gap,i}$, for the measurements conducted outside measurement gaps and within measurement gaps, respectively.

### 9.1.5.1 Monitoring of multiple layers outside gaps

The carrier-specific scaling factor $CSSF_{outside\_gap,i}$ for measurement object *i* derived in this chapter is applied to following measurement types:

- Intra-frequency measurement with no measurement gap in Section 9.2.5, when none of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- Intra-frequency measurement with no measurement gap in Section 9.2.5, when part of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

UE is expected to conduct the measurement of this measurement object *i* only outside the measurement gaps.

If the higher layer signaling in TS 38.331 [2] signaling of *smtc2* is present and smtc1 is fully overlapping with measurement and smtc2 is partially overlapping with measurement gaps, $CSSF_{outside\_gap\_i}$ and requirements derivied from $CSSF_{outside\_gap\_i}$ are not specified.

#### 9.1.5.1.1 NSA mode: carrier-specific scaling factor for SSB-based measurements performed outside gaps

For UE configured with the E-UTRA-NR dual connectivity operation, the carrier-specific scaling factor $CSSF_{outside\_gap,i}$ for intra-frequency SSB-based measurements performed outside measurements gaps will be as specified in Table 9.1.5.1.1-1.

*Editor's note : $CSSF_{outside\_gap,i}$ for SCells on FR1 assumes that all Scell SMTC are overlapping(definition FFS). $CSSF_{outside\_gap,i}$ definition may be revised for non overlapping Scell SMTCs.*

**Table 9.1.5.1.1-1: $CSSF_{outside\_gap,i}$ scaling factor in NSA mode**

| Scenario | $CSSF_{outside\_gap,i}$ for FR1 PSCC | $CSSF_{outside\_gap,i}$ for FR1 SCC | $CSSF_{outside\_gap,i}$ for FR2 PSCC | $CSSF_{outside\_gap,i}$ for FR2 SCC where neighbour cell measurement is required | $CSSF_{outside\_gap,i}$ for FR2 SCC where neighbour cell measurement is not required |
|---|---|---|---|---|---|
| **EN-DC with FR1 only CA** | 1 | Number of configured FR1 SCell(s) | N/A | N/A | N/A |
| **EN-DC with FR2 only intra band CA** | N/A | N/A | 1 | N/A | Number of configured FR2 SCells |
| **EN-DC with FR1 +FR2 CA (FR1 PSCell) Note 1** | 1 | 2×(Number of configured SCell(s)-1) | N/A | 2 | 2×(Number of configured SCell(s)-1) |
| **EN-DC with FR1 +FR2 CA (FR2 PSCell) Note 1** | N/A | Number of configured SCell(s) | 1 | N/A | Number of configured SCell(s) |
| Note 1: Only one NR FR1 operating band and one NR FR2 operating band are included for FR1+FR2 inter-band EN-DC. | | | | | |

#### 9.1.5.1.2 SA mode: carrier-specific scaling factor for SSB-based measurements performed outside gaps

For UE configured with the SA operation, the carrier-specific scaling factor $CSSF_{outside\_gap,i}$ for intra-frequency SSB-based measurements performed outside measurements gaps will be as specified in Table 9.1.5.1.2-1.

*Editor's note : $CSSF_{outside\_gap,i}$ for SCells on FR1 assumes that all Scell SMTC are overlapping(definition FFS). $CSSF_{outside\_gap,i}$ definition may be revised for non overlapping Scell SMTCs.*

**Table 9.1.5.1.2-1: $CSSF_{outside\_gap,i}$ scaling factor in SA mode**

| Scenario | $CSSF_{outside\_gap,i}$ for FR1 PCC | $CSSF_{outside\_gap,i}$ for FR1 SCC | $CSSF_{outside\_gap,i}$ for FR2 PCC | $CSSF_{outside\_gap,i}$ for FR2 SCC where neighbour cell measurement is required | $CSSF_{outside\_gap,i}$ for FR2 SCC where neighbour cell measurement is not required |
|---|---|---|---|---|---|
| **FR1 only CA** | 1 | Number of configured FR1 SCell(s) | N/A | N/A | N/A |
| **FR2 only intra band CA** | N/A | N/A | 1 | N/A | Number of configured FR2 SCell(s) |
| **FR1 +FR2 CA (FR1 PCell) Note 1** | 1 | 2×(Number of configured SCell(s)-1) | N/A | 2 | 2×(Number of configured SCell(s)-1) |
| Note 1: Only one FR1 operating band and one FR2 operating band are included for FR1+FR2 inter-band CA. | | | | | |

### 9.1.5.2 Monitoring of multiple layers within gaps

The carrier-specific scaling factor $CSSF_{within\_gap,i}$ for measurement object *i* derived in this chapter is applied to following measurement types:

- Intra-frequency measurement with no measurement gap in Section 9.2.5, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- Intra-frequency measurement with measurement gap in Section 9.2.6.

- Inter-frequency measurement in Section 9.3

- Inter-RAT measurement in Section 9.4

UE is expected to conduct the measurement of this measurement object *i* only within the measurement gaps.

If the higher layer signaling in TS 38.331 [2] signaling of *smtc2* is present and smtc1 is fully overlapping with measurement and smtc2 is partially overlapping with measurement gaps, $CSSF_{\text{within\_gap\_i}}$ and requirements derivied from $CSSF_{\text{outside\_gap\_i}}$ are not specified.

### 9.1.5.2.1 NSA mode: carrier-specific scaling factor for SSB-based measurements performed within gaps

*Editor's note: The scaling value $CSSF_{within\_gap,i}$ below has been derived without considering GSM inter-RAT carriers.*

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as $\text{CSSF}_{\text{within\_gap,i}}$ and is derived as described in this section.

If measurement object *i* refers to an RSTD measurement with periodicity Tprs>160ms, $\text{CSSF}_{\text{within\_gap,i}}$=1. Otherwise, the the $\text{CSSF}_{\text{within\_gap,i}}$ for other measurement objects (including RSTD measurement with periodicity Tprs=160ms) participate in the gap competition are derived as below.

For each measurement gap *j* not used for an RSTD measurement with periodicity Tprs>160ms within an arbitrary 160ms period, count the total number of intrafrequency measurement objects and interfrequency/interRAT measurement objects which are candidates to be measured within the gap *j*.

- An NR carrier is a candidate to be measured in a gap if its SMTC occasion fully occurs in time within the considered measurement gap excluding RF switching time. For intrafrequency NR carriers, if the high layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; Otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

- An interRAT measurement object is a candidate to be measured in all meausrement gaps.

$R_i$ is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate and not used for RSTD measurement with periodicity Tprs>160ms within an arbitrary 1280ms period.

For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis.

Per gap *j*:

$M_{\text{intra,i,j}}$: Number of intrafrequency measurement objects which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{\text{intra,i,j}}$ equals 0.

$M_{\text{inter,i,j}}$ : Number of NR interfrequency measurement objects or NR interRAT measurement objects configured by E-UTRA PCell, EUTRA interfrequency measurement objects configured by E-UTRA PCell, UTRA inter-RAT measurement objects and GSM interRAT measurement objects configured by E-UTRA PCell which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{\text{inter,i,j}}$ equals 0.

$M_{\text{tot,i,j}} = M_{\text{intra,i,j}} + M_{\text{inter,i,j}}$ : Total number of intrafrequency, interfrequency and interRAT measurement objects which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{\text{tot,i,j}}$ equals 0.

The carrier specific scaling factor $\text{CSSF}_{\text{within\_gap,i}}$ is given by:

If *measGapSharingScheme* is equal sharing, $\text{CSSF}_{\text{within\_gap,i}} = \max(\text{ceil}(R_i \times M_{\text{tot,i,j}}))$, where *j*=0…(160/MGRP)-1

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is an intrafrequency measurement object, $\text{CSSF}_{\text{within\_gap,i}}$ is the maximum among

  - ceil($R_i \times K_{intra} \times M_{intra,i,j}$) in gaps where $M_{inter,i,j} \neq 0$, where $j$=0…(160/MGRP)-1
  - ceil($R_i \times M_{intra,i,j}$) in gaps where $M_{inter,i,j}$=0, where $j$=0…(160/MGRP)-1
- measurement object *i* is an interfrequency or interRAT measurement object, $CSSF_{within\_gap,i}$ is the maximum among
  - ceil($R_i \times K_{inter} \times M_{inter,i,j}$) in gaps where $M_{intra,i,j} \neq 0$, where $j$=0…(160/MGRP)-1
  - ceil($R_i \times M_{inter,i,j}$) in gaps where $M_{intra,i,j}$=0, where $j$=0…(160/MGRP)-1

#### 9.1.5.2.2 SA mode: carrier-specific scaling factor for SSB-based measurements performed within gaps

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as $CSSF_{within\_gap,i}$ and is derived as described in this section.

If measurement object *i* refers to an RSTD measurement with periodicity Tprs>160ms, $CSSF_{within\_gap,i}$=1. Otherwise, the the $CSSF_{within\_gap,i}$ for other measurement objects (including RSTD measurement with periodicity Tprs=160ms) participate in the gap competition and the $CSSF_{within\_gap,i}$ are derived as below.

For each measurement gap *j* not used for an RSTD measurement with periodicity Tprs>160ms within an arbitrary 160ms period, count the total number of intrafrequency measurement objects and interfrequency/interRAT measurement objects which are candidates to be measured within the gap *j*.

- An NR carrier is a candidate to be measured in a gap if its SMTC occasion fully occurs in time within the considered measurement gap excluding RF switching time. For intrafrequency NR carriers, if the high layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; Otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.
- An interRAT measurement object is a candidate to be measured in all meausrement gaps.

$R_i$ is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate and not used for RSTD measurement with periodicity Tprs>160ms within an arbitrary 1280ms period.

For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis.

Per gap *j*:

$M_{intra,i,j}$: Number of intrafrequency measurement objects which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{intra,i,j}$ equals 0.

$M_{inter,i,j}$ : Number of NR interfrequency and EUTRA interRAT measurement objects which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{inter,i,j}$ equals 0.

$M_{tot,i,j} = M_{intra,i,j} + M_{inter,i,j}$ : Total number of intrafrequency, interfrequency and interRAT measurement objects which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{tot,i,j}$ equals 0.

The carrier specific scaling factor $CSSF_{within\_gap,i}$ is given by:

If *measGapSharingScheme* is equal sharing, $CSSF_{within\_gap,i}$= max(ceil($R_i \times M_{tot,i,j}$)), where $j$=0…(160/MGRP)-1

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is an intrafrequency measurement object, $CSSF_{within\_gap,i}$ is the maximum among
  - ceil($R_i \times K_{intra} \times M_{intra,i,j}$) in gaps where $M_{inter,i,j} \neq 0$, where $j$=0…(160/MGRP)-1
  - ceil($R_i \times M_{intra,i,j}$) in gaps where $M_{inter,i,j}$=0, where $j$=0…(160/MGRP)-1
- measurement object *i* is an interfrequency or interRAT measurement object, $CSSF_{within\_gap,i}$ is the maximum among
  - ceil($R_i \times K_{inter} \times M_{inter,i,j}$) in gaps where $M_{intra,i,j} \neq 0$, where $j$=0…(160/MGRP)-1

- ceil($R_i \times M_{inter,i,j}$) in gaps where $M_{intra,i,j}$=0, where $j$=0…(160/MGRP)-1

### 9.1.6 Minimum requirement at transitions

When the measurement on one intra-frequency measurement object transitions from measurements performed outside gaps to measurements performed within gaps or vice versa during one measurement period, the cell identification and measurement period requirements with the longer delay apply.

The carrier-specific scaling factor specified in Section 9.1.5 that applies to the other impacted measurement objects will also apply based on the longer measurement or cell identification delay before or after the transition.

When the UE transitions between DRX and non-DRX or when DRX cycle periodicity changes, the cell identification and measurement period requirements apply based on the longer delay before or after the transition.

Subsequent to this measurement period, the cell identification and measurement period requirements on each measurement object are corresponding to the second mode after transition.

## 9.2 NR intra-frequency measurements

### 9.2.1 Introduction

A measurement is defined as a SSB based intra-frequency measurement provided the centre frequency of the SSB of the serving cell indicated for measurement and the centre frequency of the SSB of the neighbour cell are the same, and the subcarrier spacing of the two SSB are also the same.

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

The UE can perform intra-frequency SSB based measurements without measurement gaps if

- the SSB is completely contained in the active BWP of the UE, or
- the active downlink BWP is initial BWP[3].

For intra-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in section 9.2.5.3.

SSB based measurements are configured along with one or two measurement timing configuration(s) (SMTC) which provides periodicity, duration and offset information on a window of up to 5ms where the measurements are to be performed. For intra-frequency connected mode measurements, up to two measurement window periodicities may be configured. A single measurement window offset and measurement duration are configured per intra-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB which start earlier than the gap starting time + switching time, nor detect SSB which end later than the gap end – switching time. Switching time is 0.5ms for frequency range FR1 and 0.25ms for frequency range FR2.

### 9.2.2 Requirements applicability

The requirements in Section 9.2 apply, provided:

- The cell being identified or measured is detectable.

An intra-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in Sections 10.1.2 and 10.1.3 for FR1 and FR2, respectively, for a corresponding Band,
- SS-RSRQ related side conditions given in Sections 10.1.7 and 10.1.8 for FR1 and FR2, respectively, for a corresponding Band,
- SS-SINR related side conditions given in Sections 10.1.12 and 10.1.13 for FR1 and FR2, respectively, for a corresponding Band,

- SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding Band.

## 9.2.3 Number of cells and number of SSB

### 9.2.3.1 Requirements for FR1

For each intra-frequency layer, the UE shall be capable of monitoring at least 8 cells.

For each intra-frequency layer, during each layer 1 measurement period, the UE shall be capable of monitoring at least [14] SSBs with different SSB index and/or PCI on the intra-frequency layer, where the number of SSBs in the serving cell (except for the SCell) is no smaller than the number of configured RLM-RS SSB resources.

### 9.2.3.2 Requirements for FR2

For each intra-frequency layer the UE shall be capable of monitoring at least 6 cells on a single serving carrier (PCC or PSCC or 1 SCC if PCC/PSCC is in a band different from SCC) out of all the serving carriers configured in the same band.

For each intra-frequency layer, during each layer 1 measurement period, the UE shall be capable of monitoring at least 24 SSB with different SSB index and/or PCI on a single serving carrier (PCC or PSCC or 1 SCC if PCC/PSCC is in a band different from SCC) out of all the serving carriers configured in the same band. UE shall be capable of monitoring 2 SSB(s) on serving cell for each of the other serving carrier(s) in the same band. UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR on all above-mentioned SSBs

## 9.2.4 Measurement Reporting Requirements

### 9.2.4.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 10.1.2.1, 10.1.3.1, 10.1.7.1, 10.1.8.1, 10.1.12.1 and 10.1.13.1, respectively.

### 9.2.4.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 10.1.2.1, 10.1.3.1, 10.1.7.1, 10.1.8.1, 10.1.12.1 and 10.1.13.1, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.2.4.3.

### 9.2.4.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 10.1.2.1, 10.1.3.1, 10.1.7.1, 10.1.8.1, 10.1.12.1 and 10.1.13.1, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x $TTI_{DCCH}$. This measurement reporting delay excludes a delay which caused by no UL resoureces for UE to send the measurement repor

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{\text{identify intra with index}}$ or $T_{\text{identify intra without index}}$ defined in clause 9.2.5.1 or clause 9.2.6.2. When L3 filtering is used an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{\text{identify intra without index}}$ or $T_{\text{identify intra with index}}$ defined in clause 9.2.5.1 or clause 9.2.6.2 becomes undetectable for a period and then the cell becomes detectable again and triggers an event, the event triggered measurement reporting delay shall be less than $T_{\text{Measurement\_Period, Intra}}$ provided the timing to that cell has not changed more than ± 3200 Tc while the measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used, an additional delay can be expected.

## 9.2.5 Intrafrequency measurements without measurement gaps

### 9.2.5.1 Intrafrequency cell identification

*Editor's Note :The requirements below have been derived without considering gap sharing when all SMTC occasion are fully overlapping with measurement gaps.*

The UE shall be able to identify a new detectable intra frequency cell within $T_{identify\_intra\_without\_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index(*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE has been indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within $T_{identify\_intra\_with\_index}$. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{identify\_intra\_without\_index.}$ It is assumed that *deriveSSB-IndexFromCell*is always enabled for FR1 TDD and FR2.

$$T_{identify\_intra\_without\_index} = (T_{PSS/SSS\_sync\_intra} + T_{SSB\_measurement\_period\_intra})\ ms$$

$$T_{identify\_intra\_with\_index} = (T_{PSS/SSS\_sync\_intra} + T_{SSB\_measurement\_period\_intra} + T_{SSB\_time\_index\_intra})\ ms$$

Where:

$T_{PSS/SSS\_sync\_intra}$: it is the time period used in PSS/SSS detection given in table 9.2.5.1-1, 9.2.5.1-2, 9.2.5.1-4 (deactivated Scell) or 9.2.5.1-5 (deactivated SCell)

$T_{SSB\_time\_index\_intra}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2.5.1-3 or 9.2.5.1-6 (deactivated SCell)

$T_{SSB\_measurement\_period\_intra}$: equal to a measurement period of SSB based measurement given in table 9.2.5.2-1, table 9.2.5.2-2 table 9.2.5.2-3 (deactivated Scell) or 9.2.5.2-4(deactivated SCell)

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined according to $CSSF_{outside\_gap,i}$ in section 9.1.5.1 for measurement conducted outside measurement gaps or according to $CSSF_{within\_gap,i}$ in section 9.1.5.2 for measurement conducted within measurement gaps.

$M_{pss/sss\_sync\_w/o\_gaps}$ : For a UE supporting FR2 power class 1(fixed wireless access), $M_{pss/sss\_sync}$=40. For a UE supporting power class 2(vehicle mounted), $M_{pss/sss\_sync\_w/o\_gaps}$ =24. For a UE supporting FR2 power class 3(handheld), $M_{pss/sss\_sync\_w/o\_gaps}$ =24. For a UE supporting FR2 power class 4, $M_{pss/sss\_sync\_w/o\_gaps}$ =[24]

$M_{meas\_period\_w/o\_gaps}$ : For a UE supporting power class 1 (fixed wireless access), $M_{meas\_period\_w/o\_gaps}$ =40. For a UE supporting FR2 power class 2 (vehicle mounted), $M_{meas\_period\_w/o\_gaps}$ =24. For a UE supporting power class 3 (handheld), $M_{meas\_period\_w/o\_gaps}$ =24. For a UE supporting power class 4, $M_{meas\_period\_w/o\_gaps}$ =[24].

When intrafrequency SMTC is fully non overlapping with measurement gaps, Kp=1

When intrafrequency SMTC is partially overlapping with measurent gaps, Kp = 1/(1- (SMTC period /MGRP)), where SMTC period < MGRP

If the higher layer signaling in TS 38.331 [2] signaling of *smtc2* is present and smtc1 is fully overlapping with measurement and smtc2 is partially overlapping with measurement gaps, requirements are not specified for $T_{identify\_intra\_without\_index}$ or $T_{identify\_intra\_with\_index}$

For FR2 when RLM-RS outside measurement gap is fully overlapping with intra-frequency SMTC, $K_{RLM}$= 1.5, otherwise $K_{RLM}$=1.

*Editor's note : It is FFS how requirements are defined for the case that SMTC are fully overlapping with measurement gap*

If SCG DRX is in use, intrafrequency cell identification requirements specified in Table 9.2.5.1-1, Table 9.2.5.1-2, Table 9.2.5.1-3, Table 9.2.5.1-4, Table 9.2.5.1-5 and Table 9.2.5.1-6 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

**Table 9.2.5.1-1: Time period for PSS/SSS detection, (Frequency range FR1)**

| DRX cycle | $T_{PSS/SSS\_sync\_intra}$ |
|---|---|
| No DRX | max[600ms, ceil( [5] x $K_p$) x SMTC period ]$^{Note 1}$ x $CSSF_{intra}$ |
| DRX cycle≤ 320ms | max[600ms, ceil(1.5x [5] x $K_p$) x max(SMTC period,DRX cycle)] x $CSSF_{intra}$ |
| DRX cycle>320ms | Ceil([5] x $K_p$) x DRX cycle x $CSSF_{intra}$ |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |

**Table 9.2.5.1-2: Time period for PSS/SSS detection, (Frequency range FR2)**

| DRX cycle | $T_{PSS/SSS\_sync\_intra}$ |
|---|---|
| No DRX | max[600ms, ceil($M_{pss/sss\_sync\_w/o\_gaps}$ x $K_p$ x $K_{RLM}$) x SMTC period]$^{Note 1}$ x $CSSF_{intra}$ |
| DRX cycle≤ 320ms | max[600ms, ceil(1.5 x $M_{pss/sss\_sync\_w/o\_gaps}$ x $K_p$ x $K_{RLM}$) x max(SMTC period,DRX cycle)] x $CSSF_{intra}$ |
| DRX cycle>320ms | Ceil($M_{pss/sss\_sync\_w/o\_gaps}$ x $K_p$ x $K_{RLM}$) x DRX cycle x $CSSF_{intra}$ |
| ... | ... |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |

**Table 9.2.5.1-3: Time period for time index detection (Frequency range FR1)**

| DRX cycle | $T_{SSB\_time\_index\_intra}$ |
|---|---|
| No DRX | max[120ms, ceil( 3 x $K_p$ ) x SMTC period]$^{Note 1}$ x $CSSF_{intra}$ |
| DRX cycle≤ 320ms | max[120ms, ceil (1.5 x 3 x $K_p$) x max(SMTC period,DRX cycle)] x $CSSF_{intra}$ |
| DRX cycle>320ms | Ceil(3 x $K_p$) x DRX cycle x $CSSF_{intra}$ |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |

**Table 9.2.5.1-4: Time period for PSS/SSS detection, deactivated SCell (Frequency range FR1)**

| DRX cycle | $T_{PSS/SSS\_sync\_intra}$ |
|---|---|
| No DRX | [5] x measCycleSCell x $CSSF_{intra}$ |
| DRX cycle≤ 320ms | [5] x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$ |
| DRX cycle> 320ms | [5] x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$ |

**Table 9.2.5.1-5: Time period for PSS/SSS detection, deactivated SCell (Frequency range FR2)**

| DRX cycle | $T_{PSS/SSS\_sync\_intra}$ |
|---|---|
| No DRX | $M_{pss/sss\_sync\_w/o\_gaps}$ x measCycleSCell x $CSSF_{intra}$ |
| DRX cycle≤ 320ms | $M_{pss/sss\_sync\_w/o\_gaps}$ x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$ |
| DRX cycle> 320ms | $M_{pss/sss\_sync\_w/o\_gaps}$ x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$ |

**Table 9.2.5.1-6: Time period for time index detection, deactivated SCell (Frequency range FR1)**

| DRX cycle | $T_{SSB\_time\_index\_intra}$ |
|---|---|
| No DRX | [3] x measCycleSCell x $CSSF_{intra}$ |
| DRX cycle≤ 320ms | [3] x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$ |
| DRX cycle> 320ms | [3] x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$ |

**Table 9.2.5.1-7: Void**

**Table 9.2.5.1-8: Void**

### 9.2.5.2 Measurement period

*Editor's Note : The requirements below have been derived so far assuming no configured Scell or E-UTRA SCell. The requirements when one or more SCells or E-UTRA SCells are configured is for further study. The requirements below have been derived without considering gap sharing when all SMTC occasion are fully overlapping with measurement gaps.*

The measurement period for intrafrequency measurements without gaps is as shown in table 9.2.5.2-1, 9.2.5.2-2, 9.2.5.2-3 (deactivated SCell) or 9.2.5.2-4(deactivated SCell). If the higher layer signaling in TS 38.331 [2] signaling of *smtc2* is present and smtc1 is fully overlapping with measurement and smtc2 is partially overlapping with measurement gaps, requirements are not specified for $T_{SSB\_measurement\_period\_intra}$

If SCG DRX is in use, intrafrequency measurement period requirements specified in Table 9.2.5.2-1, Table 9.2.5.2-2, Table 9.2.5.2-3 and Table 9.2.5.2-4 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

**Table 9.2.5.2-1: Measurement period for intrafrequency measurements without gaps(Frequency FR1)**

| DRX cycle | $T_{SSB\_measurement\_peiod\_intra}$ |
|---|---|
| No DRX | max[200ms, ceil( 5 x $K_p$) x SMTC period ]$^{Note\ 1}$ x $CSSF_{intra}$ |
| DRX cycle≤ 320ms | max[200ms, ceil(1.5x 5 x $K_p$) x max(SMTC period,DRX cycle)] x $CSSF_{intra}$ |
| DRX cycle>320ms | ceil( 5 x $K_p$ ) x DRX cycle x $CSSF_{intra}$ |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |

**Table 9.2.5.2-2: Measurement period for intrafrequency measurements without gaps(Frequency FR2)**

| DRX cycle | $T_{SSB\_measurement\_period\_intra}$ |
|---|---|
| No DRX | max[400ms, ceil($M_{meas\_period\_w/o\_gaps}$ x $K_p$ x $K_{RLM}$) x SMTC period]$^{Note\ 1}$ x $CSSF_{intra}$ |
| DRX cycle≤ 320ms | max[400ms, ceil(1.5x $M_{meas\_period\_w/o\_gaps}$ x $K_p$ x $K_{RLM}$) x max(SMTC period,DRX cycle)] x $CSSF_{intra}$ |
| DRX cycle>320ms | ceil($M_{meas\_period\_w/o\_gaps}$ x$K_p$ x $K_{RLM}$ ) x DRX cycle x $CSSF_{intra}$ |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |

**Table 9.2.5.2-3: Measurement period for intrafrequency measurements without gaps (deactivated SCell) (Frequency range FR1)**

| DRX cycle | $T_{SSB\_measurement\_period\_intra}$ |
|---|---|
| No DRX | [5] x measCycleSCell x $CSSF_{intra}$ |
| DRX cycle≤ 320ms | [5] x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$ |
| DRX cycle> 320ms | [5] x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$ |

**Table 9.2.5.2-4: Measurement period for intrafrequency measurements without gaps (deactivated SCell) (Frequency range FR2)**

| DRX cycle | $T_{SSB\_measurement\_period\_intra}$ |
|---|---|
| No DRX | $M_{meas\_period\ with\_gaps}$ x measCycleSCell x $CSSF_{intra}$ |
| DRX cycle≤ 320ms | $M_{meas\_period\ with\_gaps}$ x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$ |
| DRX cycle> 320ms | $M_{meas\_period\ with\_gaps}$ x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$ |

#### 9.2.5.3 Scheduling availability of UE during intra-frequency measurements

UE are required to be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE. When the measurement signal has different subcarrier spacing than PDSCH/PDCCH or on frequency range FR2, there are restrictions on the scheduling availability as described in the following clauses.

##### 9.2.5.3.1 Scheduling availability of UE performing measurements with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to measurements performed with a same subcarrier spacing as PDSCH/PDCCH on FR1.

##### 9.2.5.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to measurements. For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If *deriveSSB_IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols and 1 data symbol after each consecutive SSB symbols within SMTC window duration. If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.
- If *deriveSSB_IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration. If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

When intra-band carrier aggregation is performed, the scheduling restrictions apply to all serving cells on the band. When inter-band carrier aggregation within FR1 is performed, there are no scheduling restrictions on FR1 serving cell(s) in the bands due to measurements performed on FR1 serving cell frequency layer in different bands.

##### 9.2.5.3.3 Scheduling availability of UE performing measurements on FR2

The following scheduling restriction applies due to SS-RSRP or SS-SINR measurement on an FR2 intra-frequency cell

The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 symbol before each consecutive SSB symbols and 1 data symbol after each consecutive SSB symbols within SMTC window duration (The signaling *deriveSSB_IndexFromCell* is always enabled for FR2) . If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

The following scheduling restriction applies to SS-RSRQ measurement on an FR2 intra-frequency cell

- UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB/RSSI symbols and 1 data symbol after each consecutive SSB/RSSI symbols within SMTC window duration (The signaling *deriveSSB_IndexFromCellc* is always enabled for FR2). If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

When intra-band carrier aggregation is performed, the scheduling restrictions apply to all serving cells on the band. When inter-band carrier aggregation within FR2 is performed, the scheduling restrictions apply to all serving cells on the bands.

*Editor's Note: FFS scheduling restrictions for inter-band carrier aggregation will be defined depending on band combination in future.*

##### 9.2.5.3.4 Scheduling availability of UE performing measurements on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to measurements performed on FR2 serving cell frequency layer.

There are no scheduling restrictions on FR2 serving cell(s) due to measurements performed on FR1 serving cell frequency layer.

### 9.2.6 Intrafrequency measurements with measurement gaps

#### 9.2.6.1 Void

#### 9.2.6.2 Intrafrequency cell identification

*Editor's Note : The impact of gap sharing between intrafrequency and interfrequency measurements has not been include in the requirements below.*

The UE shall be able to identify a new detectable intra frequency cell within $T_{identify\_intra\_without\_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE has been indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within $T_{identify\_intra\_with\_index.}$ The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{identify\_intra\_without\_index.}$ It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2.

$$T_{identify\_intra\_without\_index} = T_{PSS/SSS\_sync\_intra} + T_{SSB\_measurement\_period\_intra} \text{ ms}$$

$$T_{identify\_intra\_with\_index} = T_{PSS/SSS\_sync\_ntra} + T_{SSB\_measurement\_period\_intra} + T_{SSB\_time\_index\_intra}$$

Where:

$T_{PSS/SSS\_sync\_intra}$: it is the time period used in PSS/SSS detection given in table 9.2.6.2-1 or 9.2.6.2-2.

$T_{SSB\_time\_index\_intra}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2.6.2-3.

$T_{SSB\_measurement\_period\_intra}$: equal to a measurement period of SSB based measurement given in table 9.2.6.2-1 or 9.2.6.2-2.

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within\_gap,i}$ in section [9.1.5.2] for measurement conducted within measurement gaps.

$M_{pss/sss\_sync\_with\_gaps}$ : For a UE supporting FR2 power class 1(fixed wireless access), $M_{pss/sss\_sync\ with\_gaps}$=40. For a UE supporting FR2 power class 2(vehicle mounted), $M_{pss/sss\_sync\ with\_gaps}$ =24. For a UE supporting FR2 power class 3(handheld), $M_{pss/sss\_sync\ with\_gaps}$ =24. For a UE supporting power class 4, $M_{pss/sss\_sync\ with\_gaps}$ =[24]

$M_{meas\_period\_\ with\_gaps}$: For a UE supporting power class 1(fixed wireless access), $M_{meas\_period\_\ with\_gaps}$ =40. For a UE supporting power class 2(vehicle mounted), $M_{meas\_period\_\ with\_gaps}$ =24. For a UE supporting power class 3(handheld), $M_{meas\_period\_\ with\_gaps}$ =24. For a UE supporting power class 4, $M_{meas\_period\ with\_gaps}$ =[24].

**If SCG DRX is in use, intrafrequency cell identification requirements specified in Table 9.2.6.1-1, Table 9.2.6.1-2, and Table 9.2.5.1-3 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.Table 9.2.6.2-1: Time period for PSS/SSS detection (Frequency range FR1)**

| DRX cycle | $T_{PSS/SSS\_sync\_intra}$ |
|---|---|
| No DRX | max[600ms, [5] x max(MGRP, SMTC period)] x $CSSF_{intra}$ |
| DRX cycle≤ 320ms | max[600ms, ceil(1.5x [5]) x max(MGRP, SMTC period,DRX cycle)] x $CSSF_{intra}$ |
| DRX cycle>320ms | [5] x max(MGRP, DRX cycle) x $CSSF_{intra}$ |

**Table 9.2.6.2-2: Time period for PSS/SSS detection (Frequency range FR2)**

| DRX cycle | $T_{PSS/SSS\_sync\_intra}$ |
|---|---|
| No DRX | max[600ms, $M_{pss/sss\_sync\_with\_gaps}$ x max(MGRP, SMTC period)] x $CSSF_{intra}$ |
| DRX cycle≤ 320ms | max[600ms, ceil(1.5x $M_{pss/sss\_sync\_with\_gaps}$) x max(MGRP, SMTC period, DRX cycle)] x $CSSF_{intra}$ |
| DRX cycle>320ms | $M_{pss/sss\_sync\_with\_gaps}$ x max(MGRP, DRX cycle) x $CSSF_{intra}$ |

**Table 9.2.6.2-3: Time period for time index detection (Frequency range FR1)**

| DRX cycle | $T_{SSB\_time\_index\_intra}$ |
|---|---|
| No DRX | max[120ms, 3 x max(MGRP, SMTC period] ) x $CSSF_{intra}$ |
| DRX cycle≤ 320ms | max[120ms, ceil(1.5x 3) x max(MGRP, SMTC period,DRX cycle) x $CSSF_{intra}$] |
| DRX cycle>320ms | 3 x max(MGRP, DRX cycle) x $CSSF_{intra}$ |

**Table 9.2.6.2-4: VoidTable 9.2.6.2-5: Void**Table 9.2.6.2-6: Void**Table 9.2.6.2-7: Void**

**Table 9.2.6.2-8: Void**

### 9.2.6.3 Intrafrequency Measurement Period

*Editor's Note : The requirements below have been derived so far assuming no configured Scell or E-UTRA SCell. The requirements when one or more SCells or E-UTRA SCells are configured is for further study. . The impact of gap sharing between intrafrequency and interfrequency measurements has not been include in the requirements below.*

The measurement period for FR1 intrafrequency measurements with gaps is as shown in table 9.2.6.3-1.

The measurement period for FR2 intrafrequency measurements with gaps is as shown in table 9.2.6.3-2 .

If SCG DRX is in use, intrafrequency measurement period requirements specified in Table 9.2.6.3-1and Table 9.2.6.3-2, shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

*Editor's note: The values of X, Y and N in the following tables are to be updated.*

**Table 9.2.6.3-1: Measurement period for intrafrequency measurements with gaps(Frequency Range FR1)**

| DRX cycle | $T_{SSB\_measurement\_period\_intra}$ |
|---|---|
| No DRX | max[200ms, 5 x max(MGRP, SMTC period)] x $CSSF_{intra}$ |
| DRX cycle≤ 320ms | max[200ms, ceil(1.5x 5) x max(MGRP, SMTC period,DRX cycle)] x $CSSF_{intra}$ |
| DRX cycle>320ms | 5 x max(MGRP, DRX cycle) x $CSSF_{intra}$ |

**Table 9.2.6.3-2: Measurement period for intrafrequency measurements with gaps(Frequency Range FR2)**

| DRX cycle | $T_{SSB\_measurement\_period\_intra}$ |
|---|---|
| No DRX | max[400ms, $M_{meas\_period\ with\_gaps}$ x max(MGRP, SMTC period)] x $CSSF_{intra}$ |
| DRX cycle≤ 320ms | max[400ms, ceil(1.5 x $M_{meas\_period\ with\_gaps}$) x max(MGRP, SMTC period, DRX cycle)] $^{Note\ 1}$ x $CSSF_{intra}$ |
| DRX cycle>320ms | $M_{meas\_period\ with\_gaps}$ x max(MGRP, DRX cycle) x $CSSF_{intra}$ |

**Table 9.2.6.3-3: VoidTable 9.2.6.3-4: Void**

# 9.3 NR inter-frequency measurements

## 9.3.1 Introduction

A measurement is defined as a SSB based inter-frequency measurement provided it is not defined as in intra-frequency measurement according to section 9.2.

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

SSB based measurements are configured along with a measurement timing configuration (SMTC) per carrier, which provides periodicity, duration and offset information on a window of up to 5ms where the measurements on the configured inter-frequency carrier are to be performed. For inter-frequency connected mode measurements, one measurement window periodicity may be configured per inter-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB on an inter-frequency measurement object which start earlier than the gap starting time + switching time, nor detect SSB which end later than the gap end – switching time. When the inter-frequency cells are in FR2 and the per-FR gap is configured to the UE in EN-DC and SA, or the serving cells are in FR2, the inter-frequency cells are in FR2 and the per-UE gap is configured to the UE in SA, the switching time is 0,25ms Otherwise the switching time is 0.5ms.

## 9.3.2 Requirements applicability

The requirements in Section 9.3 apply, provided:

- The cell being identified or measured is detectable.

An inter-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in Sections 10.1.4 and 10.1.5 for FR1 and FR2, respectively, for a corresponding Band,
- SS-RSRQ related side conditions given in Sections 10.1.9 and 10.1.10 for FR1 and FR2, respectively, for a corresponding Band,
- SS-SINR related side conditions given in Sections 10.1.14 and 10.1.15 for FR1 and FR2, respectively, for a corresponding Band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding Band.

### 9.3.2.1 Void

### 9.3.2.2 Void

## 9.3.3 Number of cells and number of SSB

### 9.3.3.1 Requirements for FR1

For each inter-frequency layer, the UE shall be capable of monitoring at least 4 cells.

For each inter-frequency layer, during each layer 1 measurement period, the UE shall be capable of monitoring at least 7 SSBs with different SSB index and/or PCI on the inter-frequency layer.

### 9.3.3.2 Requirements for FR2

For each inter-frequency layer, the UE shall be capable of monitoring at least 4 cells.

For each inter-frequency layer, during each layer 1 measurement period, the UE shall be capable of monitoring at least 10 SSBs with different SSB index and/or PCI on the inter-frequency layer. The UE shall be capable of monitoring at least one SSB per cell.

## 9.3.4 Inter frequency cell identification

When measurement gaps are provided, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable inter frequency cell within $T_{identify\_inter\_without\_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter frequency cell within $T_{identify\_inter\_with\_index}$. The UE shall be able to identify a new detectable inter frequency SS block of an already detected cell within $T_{identify\_inter\_without\_index}$.

$$T_{identify\_inter\_without\_index} = (T_{PSS/SSS\_sync\_inter} + T_{SSB\_measurement\_period\_inter})\ ms$$

$$T_{identify\_inter\_with\_index} = (T_{PSS/SSS\_sync\_inter} + T_{SSB\_measurement\_period\_inter} + T_{SSB\_time\_index\_inter})\ ms$$

Where:

$T_{PSS/SSS\_sync\_inter}$: it is the time period used in PSS/SSS detection given in table 9.3.4-1 and table 9.3.4-2.

$T_{SSB\_time\_index\_inter}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3.4-3 and table 9.3.4-4.

$T_{SSB\_measurement\_period\_inter}$: equal to a measurement period of SSB based measurement given in table 9.3.5-1 and table 9.3.5-2.

$M_{pss/sss\_sync\_inter}$ : For a UE supporting FR2 power class 1, $M_{pss/sss\_sync\_inter}$=64 samples. For a UE supporting FR2 power class 2 (vehicle mounted), $M_{pss/sss\_sync\_inter}$=40 samples. For a UE supporting FR2 power class 3 (handheld), $M_{pss/sss\_sync\_inter}$=40 samples. For a UE supporting FR2 power class 4, $M_{pss/sss\_sync}$=[40] samples.

$M_{SSB\_index\_inter}$: For a UE supporting power class 1, $M_{SSB\_index\_inter}$ =[40] samples. For a vehicle mounted UE supporting power class 2 (vehicle mounted), $M_{pss/sss\_sync\_inter}$=[24] samples.For a UE supporting power class 3 (handheld), $M_{SSB\_index\_inter}$ =[24] samples. For a UE supporting power class 4, $M_{meas\_period\_inter}$ =[TBD] samples.

$M_{meas\_period\_inter}$: For a UE supporting FR2 power class 1, $M_{meas\_period\_inter}$ =64 samples. For a vehicle mounted UE supporting FR2 power class 2 (vehicle mounted), $M_{pss/sss\_sync\_inter}$=40 samples.For a UE supporting FR2 power class 3 (handheld), $M_{meas\_period\_inter}$ =40 samples. For a UE supporting FR2 power class 4, $M_{meas\_period\_inter}$ =[40] samples.

$CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within\_gap,i}$ in section 9.1.5.2 for measurement conducted within measurement gaps.

**Table 9.3.4-1: Time period for PSS/SSS detection, (Frequency range FR1)**

| Condition NOTE1,2 | $T_{PSS/SSS\_sync\_inter}$ |
|---|---|
| No DRX | max[600ms, [8] x max(MGRP, SMTC period)] x $CSSF_{inter}$ |
| DRX cycle ≤ 320ms | max[600ms, ceil(8x1.5) x max(MGRP, SMTC period, DRX cycle)] x $CSSF_{inter}$ |
| DRX cycle > 320ms | [8] x DRX cycle x $CSSF_{inter}$ |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1<br>NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**Table 9.3.4-2: Time period for PSS/SSS detection, (Frequency range FR2)**

| Condition NOTE1,2 | $T_{PSS/SSS\_sync\_inter}$ |
|---|---|
| No DRX | max[600ms, $M_{pss/sss\_sync\_inter}$ x max(MGRP, SMTC period)] x $CSSF_{inter}$ |
| DRX cycle ≤ 320ms | max[600ms, (1.5 x $M_{pss/sss\_sync\_inter}$) x max(MGRP, SMTC period, DRX cycle)] x $CSSF_{inter}$ |
| DRX cycle > 320ms | $M_{pss/sss\_sync\_inter}$ x DRX cycle x $CSSF_{inter}$ |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1<br>NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**Table 9.3.4-3: Time period for time index detection (Frequency range FR1)**

| Condition NOTE1,2 | $T_{SSB\_time\_index\_inter}$ |
|---|---|
| No DRX | max[120ms, [3] x max(MGRP, SMTC period)] x $CSSF_{inter}$ |
| DRX cycle ≤ 320ms | max[120ms, ceil(3 x 1.5) x max(MGRP, SMTC period, DRX cycle)] x $CSSF_{inter}$ |
| DRX cycle > 320ms | [3] x DRX cycle x $CSSF_{inter}$ |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1<br>NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**Table 9.3.4-4: Time period for time index detection (Frequency range FR2)**

| Condition NOTE1,2 | $T_{SSB\_time\_index\_inter}$ |
|---|---|
| No DRX | max[200ms, $M_{SSB\_index\_inter}$ x max(MGRP, SMTC period)] x $CSSF_{inter}$ |
| DRX cycle ≤ 320ms | max[200ms, (1.5 x $M_{SSB\_index\_inter}$) x max(MGRP, SMTC period, DRX cycle)] x $CSSF_{inter}$ |
| DRX cycle > 320ms | $M_{SSB\_index\_inter}$ x DRX cycle x $CSSF_{inter}$ |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1<br>NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

#### 9.3.4.1 Void

#### 9.3.4.2 Void

### 9.3.5 Inter frequency measurements

When measurement gaps are provided for inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in sub-clauses 10.1.4, 10.1.5, 10.1.9, 10.1.10, 10.1.14 and 10.1.15, respectively, as shown in table 9.3.5-1 and 9.3.5-2:

**Table 9.3.5-1: Measurement period for inter-frequency measurements with gaps (Frequency FR1)**

| Condition NOTE1,2 | $T_{SSB\_measurement\_period\_inter}$ |
|---|---|
| No DRX | max[200ms, [8] x max(MGRP, SMTC period)] x $CSSF_{inter}$ |
| DRX cycle ≤ 320ms | max[200ms, ceil(8 x 1.5) x max(MGRP, SMTC period, DRX cycle)] x $CSSF_{inter}$ |
| DRX cycle > 320ms | [8] x DRX cycle x $CSSF_{inter}$ |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1<br>NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

**Table 9.3.5-2: Measurement period for inter-frequency measurements with gaps (Frequency FR2)**

| Condition NOTE1,2 | $T_{SSB\_measurement\_period\_inter}$ |
|---|---|
| No DRX | max[400ms, $M_{meas\_period\_inter}$ x max(MGRP, SMTC period)] x $CSSF_{inter}$ |
| DRX cycle ≤ 320ms | max[400ms, (1.5 x $M_{meas\_period\_inter}$) x max(MGRP, SMTC period, DRX cycle)] x $CSSF_{inter}$ |
| DRX cycle > 320ms | $M_{meas\_period\_inter}$ x DRX cycle x $CSSF_{inter}$ |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in section 3.6.1<br>NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in section 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. | |

#### 9.3.5.1 Void

#### 9.3.5.2 Void

#### 9.3.5.3 Void

### 9.3.6 NR Inter frequency measurements reporting requirements

#### 9.3.6.1 Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in sections 10.1.4.1, 10.1.5.1, 10.1.9.1, 10.1.10.1, 10.1.14.1 and 10.1.15.1, respectively.

#### 9.3.6.2 Event-triggered Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in sections 10.1.4.1, 10.1.5.1, 10.1.9.1, 10.1.10.1, 10.1.14.1 and 10.1.15.1, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.3.6.3.

#### 9.3.6.3 Event-triggered Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in sections 10.1.4.1, 10.1.5.1, 10.1.9.1, 10.1.10.1, 10.1.14.1 and 10.1.15.1, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x $TTI_{DCCH}$. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within $T_{identify\_inter\_without\_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index. Otherwise UE shall be able to identify a new detectable inter frequency cell within $T_{identify\_inter\_with\_index}$. Both $T_{identify\_inter\_without\_index}$ and $T_{identify\_inter\_with\_index}$ are defined in clause 9.3.4. When L3 filtering is used an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{identify\_inter\_without\_index}$ or $T_{identify\_inter\_with\_index}$ defined in clause 9.3.4 and then triggers the measurement report as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{SSB\_measurement\_period\_inter}$ defined in clause 9.3.5 provided the timing to that cell has not changed more than ± 3200 Tc while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used an additional delay can be expected.

### 9.3.7 Void

## 9.4 Inter-RAT measurements

### 9.4.1 Introduction

The requirements in this section are specified for NR−E-UTRAN FDD and NR−E-UTRAN TDD measurements and are applicable without an explicit E-UTRAN neighbour cell list containing physical layer cell identities, for a UE:

- in RRC_CONNECTED state, and
- configured with at least PCell, and
- configured with an appropriate measurement gap pattern according to Table 9.1.2-3.

Parameter $T_{Inter1}$ used in inter-RAT requirements in Section 9.4 is specified in Table 9.4.1-1.

**Table 9.4.1-1: Minimum available time for inter-RAT measurements**

| Gap Pattern Id | MeasurementGap Length (MGL, ms) | Measurement Gap Repetition Period (MGRP, ms) | Minimum available time for inter-frequency and inter-RAT measurements during 480ms period (Tinter1, ms) |
|---|---|---|---|
| 0 | 6 | 40 | 60 |
| 1 | 6 | 80 | 30 |
| 2 | 3 | 40 | 24 Note 1 |
| 3 | 3 | 80 | 12 Note 1 |
| 4 | 6 | 20 | 120 Note 1 |
| 6 | 4 | 20 | 72 Note 1,3,6 |
| 7 | 4 | 40 | 36 Note 1,4,6 |
| 8 | 4 | 80 | 18 Note 1,5,6 |
| 10 | 3 | 20 | 48 Note 1 |
| NOTE 1: When determing UE requirements using Tinter1 for GP2 , 3, 4, 6, 7, 8, 10, Tinter1 = 60 for GP2, GP4, GP6, GP7, GP10 and Tinter1 = 30 for GP3 and GP8 shall be used.<br>NOTE 2: Measurement gaps pattern configurations applicability is as specified in Table 9.1.2-1.NOTE 3: When this gap pattern is used, the $T_{inter}$ for E-UTRA interfrequency measurements is 48ms corresponding to the first 3ms of the 4ms gap<br>NOTE 4: When this gap pattern is used, the $T_{inter}$ for E-UTRA interfrequency measurements is 24ms corresponding to the first 3ms of the 4ms gap<br>NOTE 5: When this gap pattern is used, the $T_{inter}$ for E-UTRA interfrequency measurements is 12ms corresponding to the first 3ms of the 4ms gap<br>NOTE 6: This gap pattern is applicable for E-UTRA interfrequency measurements only if gap based NR measurements are also configured. | | | |

*Editor's note: a note to be added in Table 9.4.1-1 on that measurement gap patterns #2 #3, #6, #7, #8, #10 are supported only by the UEs which have a corresponding capability once RAN2 specifies the capability.*

A UE configured with gap pattern Id 2, 3 or 10, shall be able to detect a target cell if the E-UTRA sub frame #0 or #5 of the target cell begins no earlier than [500]uS from the start of the measurement gap and if the E-UTRA sub frame #0 or #5 of the target cell ends no later than [500]uS before the end of the measurement gap in case of FDD, and no later than [750]us before the end of measurement gap in case of TDD.

A UE configured with gap pattern Id 6, 7 or 8 shall be able to detect a target cell if the E-UTRA sub frame #0 or #5 of the target cell begins no earlier than [500]uS from the start of the measurement gap and if the E-UTRA sub frame #0 or #5 of the target cell ends no later than [1500]uS before the end of the measurement gap in case of FDD, and no later than [1750]us before the end of measurement gap in case of TDD.

## 9.4.2 SA: NR − E-UTRAN FDD measurements

### 9.4.2.1 Introduction

The requirements are applicable for NR−E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements.

In the requirements, an E-UTRAN FDD cell is considered to be detectable when:

- RSRP related conditions in the accuracy requirements in Section 10.2.2 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],
- RSRQ related conditions in the accuracy requirements in Section 10.2.3 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],
- RS-SINR related conditions in the accuracy requirements in Section 10.2.5 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.19 of TS 36.133 [15].

### 9.4.2.2 Requirements when no DRX is used

When the UE requires measurement gaps to idenitify and measure inter-RAT cells and an appropriate measurement gap pattern is scheduled, the UE shall be able to identify a new detectable FDD cell within $T_{Identify,\ E\text{-}UTRAN\ FDD}$ according to the following expression:

,

where:

$T_{BasicIdentify}$ = 480 ms,

$T_{Inter1}$ is defined in Section 9.4.1,

$CSSF_{interRAT} = CSSF_{within\_gap\_i\_}$ is the scaling factor for the measured inter-RAT E-UTRA carrier i which is calculated as specified in Section 9.1.5.2.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of $T_{Measure,\ E\text{-}UTRAN\ FDD}$ defined in Table 9.4.2.2-1.

**Table 9.4.2.2-1: Measurement period and measurement bandwidth**

| Configuration | Physical Layer Measurement period: $T_{Measure,\ E\text{-}UTRAN\ FDD}$ [ms] | Measurement bandwidth [RB] |
|---|---|---|
| 0 | 480 x $CSSF_{interRAT}$ | 6 |
| 1 (Note 1) | 240 x $CSSF_{interRAT}$ | 50 |
| NOTE 1: This configuration is optional. | | |

The UE shall be capable of identifying and performing NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements of at least 4 E-UTRAN FDD cells per E-UTRA FDD carrier frequency layer for up to 7 E-UTRA FDD carrier frequency layers.

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in Section 10.2.2. The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in Section 10.2.3. The NR – E-UTRAN FDD RS-SINR measurement accuracy for all measured cells shall be as specified in Section 10.2.5.

### 9.4.2.3 Requirements when DRX is used

When DRX is in use and measurement gaps are configured, the UE shall be able to identify a new detectable E-UTRAN FDD cell within $T_{Identify,\ E\text{-}UTRAN\ FDD}$ specified in Table 9.4.2.3-1.

**Table 9.4.2.3-1: Requirement to identify a newly detectable E-UTRAN FDD cell**

| DRX cycle length (s) | $T_{Identify, E-UTRAN\ FDD}$ (s) (DRX cycles) | |
|---|---|---|
| | Gap period = 40 ms, 20 ms | Gap period = 80 ms |
| ≤0.16 | Non-DRX requirements in Section 9.4.2.2 apply | Non-DRX requirements in Section 9.4.2.2 apply |
| 0.256 | 5.12*K (20*$CSSF_{interRAT}$) | 7.68*K (30*$CSSF_{interRAT}$) |
| 0.32 | 6.4*K (20*$CSSF_{interRAT}$) | 7.68*K (24*$CSSF_{interRAT}$) |
| 0.32< DRX-cycle ≤10.24 | Note1 (20*$CSSF_{interRAT}$) | Note1 (20*$CSSF_{interRAT}$) |
| NOTE 1: The time depends on the DRX cycle length.<br>NOTE 2: $CSSF_{interRAT}$ is as defined in Section 9.4.2.2. | | |

When DRX is in use, the UE shall be capable of performing NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements of at least 4 E-UTRAN FDD cells per E-UTRA FDD frequency layer for up to 7 E-UTRA FDD carrier frequency layers, and the UE physical layer shall be capable of reporting NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period $T_{measure, E-UTRAN\ FDD}$ specified in Table 9.4.2.3-2.

**Table 9.4.2.3-2: Requirement to measure E-UTRAN FDD cells**

| DRX cycle length (s) | $T_{measure, E-UTRAN\ FDD}$ (s) (DRX cycles) |
|---|---|
| ≤0.08 | Non-DRX requirements in Section 9.4.2.2 apply |
| 0< DRX-cycle ≤10.24 | Note1 (5* $CSSF_{interRAT}$) |
| NOTE 1: The time depends on the DRX cycle length.<br>NOTE 2: $CSSF_{interRAT}$ is as defined in Section 9.4.2.2. | |

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in Section 10.2.2. The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in Section 10.2.3. The NR – E-UTRAN FDD RS-SINR measurement accuracy for all measured cells shall be as specified in Section 10.2.5.

### 9.4.2.4 Measurement reporting requirements

#### 9.4.2.4.1 Periodic Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in Sections 10.2.2, 10.2.3, and 10.2.5, respectively.

#### 9.4.2.4.2 Event-Triggered Periodic Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in Sections 10.2.2, 10.2.3, and 10.2.5, respectively.

The first report in event-triggered periodic measurement reporting shall meet the requirements specified in Section 9.4.2.4.3.

#### 9.4.2.4.3 Event-Triggered Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered measurement reports shall meet the requirements in Sections 10.2.2, 10.2.3, and 10.2.5, respectively.

The UE shall not send any event-triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x $TTI_{DCCH}$ where $TTI_{DCCH}$ is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{\text{Identify, E-UTRAN FDD}}$ defined in Sections 9.4.2.2 and 9.4.2.3 without DRX and with DRX, respectively. When L3 filtering is used, an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{\text{Identify, E-UTRAN FDD}}$ becomes undetectable for a period ≤ [5] seconds and then the cell becomes detectable again and triggers an event as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{\text{Measure, E-UTRAN FDD}}$ provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used.

## 9.4.3 SA: NR − E-UTRAN TDD measurements

### 9.4.3.1 Introduction

The requirements are applicable for NR−E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements.

In the requirements, an E-UTRAN TDD cell is considered to be detectable when:

- RSRP related conditions in the accuracy requirements in Section 10.2.2 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],
- RSRQ related conditions in the accuracy requirements in Section 10.2.3 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

  RS-SINR related conditions in the accuracy requirements in Section 10.2.5 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.19 of TS 36.133 [15].-.

### 9.4.3.2 Requirements when no DRX is used

When the UE requires measurement gaps to idenitify and measure inter-RAT cells and an appropriate measurement gap pattern is scheduled, the UE shall be able to identify a new detectable TDD cell within $T_{\text{Identify, E-UTRAN TDD}}$ according to the following expression:

- When configuration 0 or configuration 1 in Table 9.4.3.2-1 is applied,

,

- When configuration 2 or configuration 3 in Table 9.4.3.2-1 is applied,

,

where:

$T_{\text{BasicIdentify}}$ = 480 ms,

$T_{\text{Inter1}}$ is defined in Section 9.4.1,

$CSSF_{\text{interRAT}} = CSSF_{\text{within\_gap\_i\_}}$ is the scaling factor for the measured inter-RAT E-UTRA carrier i which is calculated as specified in Section 9.1.5.2.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of $T_{\text{Measure, E-UTRAN TDD}}$ defined in Table 9.4.3.2-1.

**Table 9.4.3.2-1: $T_{\text{Measure, E-UTRAN TDD}}$ for different configurations**

| Configuration | Measurement bandwidth [RB] | Number of UL/DL sub-frames per half frame (5 ms) | | DwPTS | | $T_{\text{Measure, E-UTRAN TDD}}$ [ms] |
|---|---|---|---|---|---|---|
| | | DL | UL | Normal CP | Extended CP | |
| 0 | 6 | 2 | 2 | $19760 \cdot T_s$ | $20480 \cdot T_s$ | 480 x $CSSF_{\text{interRAT}}$ |
| 1 (Note 1) | 50 | 2 | 2 | $19760 \cdot T_s$ | $20480 \cdot T_s$ | 240 x $CSSF_{\text{interRAT}}$ |
| NOTE 1: This configuration is optional.NOTE 2: Void | | | | | | |

The UE shall be capable of identifying and performing NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements of at least 4 E-UTRAN TDD cells per E-UTRA TDD carrier frequency layer for up to 7 E-UTRA TDD carrier frequency layers.

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in Section 10.2.2. The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in Section 10.2.3. The NR – E-UTRAN TDD RS-SINR measurement accuracy for all measured cells shall be as specified in Section 10.2.5.

### 9.4.3.3 Requirements when DRX is used

When DRX is in use and measurement gaps are configured, the UE shall be able to identify a new detectable E-UTRAN TDD cell within $T_{Identify, E\text{-}UTRAN\ TDD}$ specified in Table 9.4.3.3-1.

**Table 9.4.3.3-1: Requirement to identify a newly detectable E-UTRAN TDD cell**

| DRX cycle length (s) | $T_{Identify, E\text{-}UTRAN\ TDD}$ (s) (DRX cycles) | |
|---|---|---|
| | Gap period = 40 ms, 20 ms | Gap period = 80 ms |
| ≤0.16 | Non-DRX requirements in Section 9.4.3.2 apply | Non-DRX requirements in Section 9.4.3.2 apply |
| 0.256 | 5.12*K (20*$CSSF_{interRAT}$) | 7.68*K (30*$CSSF_{interRAT}$) |
| 0.32 | 6.4*K (20*$CSSF_{interRAT}$) | 7.68*K (24*$CSSF_{interRAT}$) |
| 0.32< DRX-cycle ≤10.24 | Note1 (20*$CSSF_{interRAT}$) | Note1 (20*$CSSF_{interRAT}$) |
| NOTE 1: The time depends on the DRX cycle length.<br>NOTE 2: $CSSF_{interRAT}$ is as defined in Section 9.4.3.2. | | |

When DRX is in use, the UE shall be capable of performing NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements of at least 4 E-UTRAN TDD cells per E-UTRA TDD frequency layer for up to 7 E-UTRA TDD carrier frequency layers, and the UE physical layer shall be capable of reporting NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period $T_{measure, E\text{-}UTRAN\ TDD}$ specified in Table 9.4.3.3-2.

**Table 9.4.3.3-2: Requirement to measure E-UTRAN TDD cells**

| DRX cycle length (s) | $T_{measure, E\text{-}UTRAN\ TDD}$ (s) (DRX cycles) |
|---|---|
| ≤0.08 | Non-DRX Requirements in Section 9.4.3.2 apply |
| 0.128 | For configuration 2, non-DRX requirements in section 9.4.3.2 apply,<br>Otherwise: Note1 (5*$CSSF_{interRAT}$) |
| 0.128<DRX-cycle≤10.24 | Note1 (5*$CSSF_{interRAT}$) |
| NOTE 1: The time depends on the DRX cycle length.<br>NOTE 2: $CSSF_{interRAT}$ is as defined in Section 9.4.3.2. | |

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in Section 10.2.2. The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in Section 10.2.3. The NR – E-UTRAN TDD RS-SINR measurement accuracy for all measured cells shall be as specified in Section 10.2.5.

### 9.4.3.4 Measurement reporting requirements

#### 9.4.3.4.1 Periodic Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in Sections 10.2.2, 10.2.3, and 10.2.5, respectively.

#### 9.4.3.4.2 Event-Triggered Periodic Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in Sections 10.2.2, 10.2.3, and 10.2.5, respectively.

The first report in event-triggered periodic measurement reporting shall meet the requirements specified in Section 9.4.3.4.3.

#### 9.4.3.4.3 Event-Triggered Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered measurement reports shall meet the requirements in Sections 10.2.2, 10.2.3, and 10.2.5, respectively.

The UE shall not send any event-triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x $TTI_{DCCH}$ where $TTI_{DCCH}$ is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{\text{Identify, E-UTRAN TDD}}$ defined in Sections 9.4.3.2 and 9.4.3.3 without DRX and with DRX, respectively. When L3 filtering is used, an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{\text{Identify, E-UTRAN TDD}}$ becomes undetectable for a period ≤ [5] seconds and then the cell becomes detectable again and triggers an event as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{\text{Measure, E-UTRAN TDD}}$ provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used.

## 9.4.4 SA: Inter-RAT RSTD measurements

### 9.4.4.1 SA: NR − E-UTRAN FDD RSTD measurements

#### 9.4.4.1.1 Introduction

The requirements are applicable for NR−E-UTRAN FDD RSTD measuements requested via LPP [22].

The requirements in section 9.4.4.1 apply, provided:

- the UE is provided with the LTE timing information [reference TBD], including both *nr-LTE-SFN-Offset* and [*nr-LTE-fineTiming-Offset*], or
- when the UE is not aware of the SFN of at least one LTE cell in the OTDOA assistance data, the UE may be using autonomous gaps in FR1 to acquire SFN of the OTDOA assistance data reference cell prior to requesting measurement gaps for performing the requested E-UTRA RSTD measurements before the $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN FDD}}$ time period starts while meeting all the requirements in Section 9.4.4.1.2, provided that the OTDOA assistance data is provided to allow sufficient time for the UE to acquire the SFN before the starts,
- when the UE is not aware of the subframe timing difference between the NR serving cell and the OTDOA assistance data reference cell, the UE may request measurement gaps in FR1 to perform cell detection for the OTDOA assistance data reference cell prior to requesting measurement gaps for performing the requested E-UTRA RSTD measurements before the $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN FDD}}$ time period starts while meeting all the requirements in Section 9.4.4.1.2, provided that the OTDOA assistance data is provided to allow sufficient time for the UE to detect the cell before the $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN FDD}}$ starts.

#### 9.4.4.1.2 Requirements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-RAT E-UTRAN FDD RSTD, specified in TS 38.215 [4], for at least *n*=16 cells, including the reference cell, within $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN FDD}}$ ms as given below:

$$\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN FDD}} = T_{\text{PRS}} \cdot (M - 1) + \Delta \qquad ms\,,$$

where

$\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN FDD}}$ is the total time for detecting and measuring at least *n* cells,

$T_{\text{PRS}}$ is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [23], among the measured *n* cells including the reference cell,

$M$ is the number of PRS positioning occasions as defined in Table 9.4.4.1.2-1, where each PRS positioning occasion comprises of $N_{PRS}$ ($1 \le N_{PRS} \le 6$) consecutive downlink positioning subframes defined in TS 36.211 [23],

$\text{CSSF}_{\text{interRAT}} = \text{CSSF}_{\text{within\_gap\_i}}$ is the scaling factor determined by the gap sharing scheme for the RSTD measurements on the carrier frequency i as defined in Section 9.1.5.2,

$\Delta = 160 \cdot \left\lceil \frac{n}{M} \right\rceil$ ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two E-UTRAN FDD carrier frequencies.

**Table 9.4.4.1.2-1: Number of PRS positioning occasions within $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN FDD}}$**

| Positioning subframe configuration period $T_{\text{PRS}}$ | Number of PRS positioning occasions $M$ | |
|---|---|---|
| | f2 Note1 | f1 and f2 Note2 |
| 160 ms | 16 × $\text{CSSF}_{\text{interRAT}}$ | 32 × $\text{CSSF}_{\text{interRAT}}$ |
| >160 ms | 8 × $\text{CSSF}_{\text{interRAT}}$ | 16 × $\text{CSSF}_{\text{interRAT}}$ |
| NOTE 1: When inter-RAT E-UTRAN FDD RSTD measurements are performed over the reference cell and neighbour cells, which belong to the E-UTRAN FDD carrier frequency f2.<br>NOTE 2: When inter-RAT E-UTRAN FDD RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the E-UTRAN FDD carrier frequency f1 and the E-UTRAN FDD carrier frequency f2 respectively. | | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN FDD}}$ provided:

$\left(\text{PRS}\ \hat{\text{E}}_{\text{s}}/\text{Iot}\right)_{ref}$ ≥-6 dB for all Frequency Bands for the reference cell,

$\left(\text{PRS}\ \hat{\text{E}}_{\text{s}}/\text{Iot}\right)_{i}$ ≥-13 dB for all Frequency Bands for neighbour cell *i*,

$\left(\text{PRS}\ \hat{\text{E}}_{\text{s}}/\text{Iot}\right)_{ref}$ and $\left(\text{PRS}\ \hat{\text{E}}_{\text{s}}/\text{Iot}\right)_{i}$ conditions apply for all subframes of at least $L = \frac{M}{2}$ PRS positioning occasions,

PRP $1,2|_{\text{dBm}}$ according to TS 36.133 [15, Annex B.2.6] for a corresponding Band

$\text{PRS}\ \hat{\text{E}}_{\text{s}}/\text{Iot}$ is defined as the ratio of the average received energy per PRS RE during the useful part of the symbol to the average received power spectral density of the total noise and interference for this RE, where the ratio is measured over all REs which carry PRS.

The time $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN FDD}}$ starts from the first subframe of the PRS positioning occasion closest in time after both the *OTDOA-RequestLocationInformation* message and the OTDOA assistance data in the *OTDOA-ProvideAssistanceData* message via LPP as specified in TS 38.305 [22], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in Section 10.2.4.

#### 9.4.4.1.2.1 RSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x $\text{TTI}_{\text{DCCH}}$ where $\text{TTI}_{\text{DCCH}}$ is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

###### 9.4.4.1.2.2 Requirements for acquiring the timing of the E-UTRA OTDOA reference cell

When the UE is not aware of the SFN of at least one LTE cell in the OTDOA assistance data, the UE supporting per-FR gaps may make autonomous gaps in downlink reception and uplink transmission of the PCell and each of the SCells in FR1 for acquiring SFN of the reference cell in the E-UTRA OTDOA assistance data. No autonomous gaps in downlink reception or uplink transmission are allowed in any of the UE serving cells in FR2. The UE, which are only supporting per-UE gaps, may make autonomous gaps in downlink reception and uplink transmission of the PCell and each of the SCells for acquiring the SFN of the reference cell in the E-UTRA OTDOA assistance data.

When the UE is not aware of and cannot derive the subframe timing difference between the NR serving cell and the OTDOA assistance data reference cell, the UE may request measurement gaps for detecting the reference cell in the E-UTRA OTDOA assistance data.

When the UE is performning one or both of SFN acquisition or cell detection as specified above, the UE shall be able to determine the timing of the E-UTRA OTDOA assistance data reference cell during the time period

$$T_{RefCell,E\text{-}UTRAN} = T_{Detect,\ E\text{-}UTRAN\ FDD} + T_{MIB}\ ,$$

where

$T_{Detect,\ E\text{-}UTRAN\ FDD}$ = TBD and it is the time needed to detect the E-UTRA OTDOA assistance data reference cell when the UE needs to acquire the subframe and slot timing of the cell ($T_{Detect,\ E\text{-}UTRAN\ FDD}$=0 when both *nr-LTE-SFN-Offset* and *nr-LTE-fineTiming-Offset* are provded in the E-UTRA OTDOA assistance data), and

$T_{MIB}$ = 50 ms is the time required to acquire SFN of the E-UTRA OTDOA assistance data reference cell provided the OTDOA assistance data reference cell is decodable and at least all E-UTRA subframes #0 during $T_{MIB}$ are available at the UE receiver ($T_{MIB}$=0 when *nr-LTE-SFN-Offset* is provded in the E-UTRA OTDOA assistance data).

When detecting the E-UTRAN OTDOA reference cell, the requirements in this section are met, provided the conditions for the detectable cell are fulfilled according to Section 9.4.2.1. In addition, the MIB of an E-UTRA cell whose SFN is acquired shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to TS 36.101 [25].

The requirement for acquiring the timing of the E-UTRA OTDOA reference cell within $T_{RefCell,E\text{-}UTRAN}$ is applicable when no DRX is used as well as when any of the DRX cycles specified in TS 38.331 [2] is used.Within the timing acquisition time period, $T_{RefCell,E\text{-}UTRAN}$, when using autonomous gaps the UE shall transmit at least $N_{ACK/NACK,\ FDD,\ FR1}$ ACK/NACKs on PCell in FR1 or each of activated SCell(s) in the same frequency range, specified in Table 9.4.4.1.2.2-1, provided that:

- there is continuous DL data allocation,
- no DRX cycle is used,
- no measurement gaps are configured,
- only one code word is transmitted in eachslot,
- [2] slot ACK/NACK feedback is configured.

| Table 9.4.4.1.2.2-1: Number of ACK/NACKs transmitted by the UE during $T_{MIB}N_{ACK/NACK, FDD, FR1}$ | Configuration of the serving cell in which the transmitted ACK/NACKs are counted | | |
|---|---|---|---|
| | Duplex mode configuration | SCS | SMTC period |
| [TBD] | FDD | 15 kHz | 10 |
| [TBD] | FDD | 15 kHz | 20 |
| [TBD] | FDD | 15 kHz | 40 |
| [TBD] | FDD | 30 kHz | 10 |
| [TBD] | FDD | 30 kHz | 20 |
| [TBD] | FDD | 30 kHz | 40 |
| [TBD] | FDD | 60 kHz | 10 |
| [TBD] | FDD | 60 kHz | 20 |
| [TBD] | FDD | 60 kHz | 40 |
| [TBD] | TDD Note 1 | 15 kHz | 10 |
| [TBD] | TDD Note 1 | 15 kHz | 20 |
| [TBD] | TDD Note 1 | 15 kHz | 40 |
| [TBD] | TDD Note 1 | 30 kHz | 10 |
| [TBD] | TDD Note 1 | 30 kHz | 20 |
| [TBD] | TDD Note 1 | 30 kHz | 40 |
| [TBD] | TDD Note 1 | 60 kHz | 10 |
| [TBD] | TDD Note 1 | 60 kHz | 20 |
| [TBD] | TDD Note 1 | 60 kHz | 40 |
| NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. | | | |

*Editor' note: the requirement applicability with SRS carrier based switching is TBD.*

### 9.4.4.2 SA: NR − E-UTRAN TDD RSTD measurements

#### 9.4.4.2.1 Introduction

The requirements are applicable for NR−E-UTRAN TDD RSTD measurements requested via LPP [22].

The requirements in section 9.4.4.1 apply, provided:

- the UE is provided with the LTE timing information [reference TBD], including both *nr-LTE-SFN-Offset* and [*nr-LTE-fineTiming-Offset*], or
- when the UE is not aware of the SFN of at least one LTE cell in the OTDOA assistance data, the UE may be using autonomous gaps in FR1 to acquire SFN of the OTDOA assistance data reference cell prior to requesting measurement gaps for performing the requested E-UTRA RSTD measurements before the $T_{\text{RSTD InterRAT, E-UTRAN TDD}}$ time period starts while meeting all the requirements in Section 9.4.4.2.2, provided that the OTDOA assistance data is provided to allow sufficient time for the UE to acquire the SFN before the $T_{\text{RSTD InterRAT, E-UTRAN TDD}}$ starts,
- when the UE is not aware of the subframe timing difference between the NR serving cell and the OTDOA assistance data reference cell, the UE may request measurement gaps in FR1 to perform cell detection for the OTDOA assistance data reference cell prior to requesting measurement gaps for performing the requested E-UTRA RSTD measurements before the $T_{\text{RSTD InterRAT, E-UTRAN TDD}}$ time period starts while meeting all the requirements in Section 9.4.4.2.2, provided that the OTDOA assistance data is provided to allow sufficient time for the UE to detect the cell before the $T_{\text{RSTD InterRAT, E-UTRAN TDD}}$ starts.

Editor's note: the requirements applicability is FFS when the UE is provided with *cellGlobalId* [22] for the LTE OTDOA assistance data reference cell.

#### 9.4.4.2.2 Requirements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-RAT -UTRAN TDD RSTD, specified in TS 38.215 [4], for at least *n*=16 cells, including the reference cell, within $\mathrm{T}_{\mathrm{RSTD\ InterRAT,\ E\text{-}UTRAN\ TDD}}$ ms as given below:

$$\mathrm{T}_{\mathrm{RSTD\ InterRAT,\ E\text{-}UTRAN\ TDD}} = T_{\mathrm{PRS}} \cdot (M - 1) + \Delta \qquad ms \qquad ,$$

where

$\mathrm{T}_{\mathrm{RSTD\ InterRAT,\ E\text{-}UTRAN\ TDD}}$ is the total time for detecting and measuring at least *n* cells,

$T_{\mathrm{PRS}}$ is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [23], among the measured *n* cells including the reference cell,

$M$ is the number of PRS positioning occasions as defined in Table 9.4.4.2.2-1, where a PRS positioning occasion is as defined in clause 9.4.4.1.2,

$\mathrm{CSSF}_{\mathrm{interRAT}}=\mathrm{CSSF}_{\mathrm{within\_gap\_i}}$ is the scaling factor determined by the gap sharing scheme for the RSTD measurements on the carrier frequency i as defined in Section 9.1.5.2,

$\Delta = 160 \cdot \left\lceil \frac{n}{M} \right\rceil$ ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two E-UTRAN TDD carrier frequencies.

**Table 9.4.4.2.2-1: Number of PRS positioning occasions within $\mathrm{T}_{\mathrm{RSTD\ InterRAT,\ E\text{-}UTRAN\ TDD}}$**

| Positioning subframe configuration period $T_{\mathrm{PRS}}$ | Number of PRS positioning occasions $M$ | |
|---|---|---|
| | f2 Note1 | f1 and f2 Note2 |
| 160 ms | 16 × $\mathrm{CSSF}_{\mathrm{interRAT}}$ | 32 × $\mathrm{CSSF}_{\mathrm{interRAT}}$ |
| >160 ms | 8 × $\mathrm{CSSF}_{\mathrm{interRAT}}$ | 16 × $\mathrm{CSSF}_{\mathrm{interRAT}}$ |
| NOTE 1: When inter-RAT E-UTRAN TDD RSTD measurements are performed over the reference cell and neighbour cells, which belong to the E-UTRAN TDD carrier frequency f2.<br>NOTE 2: When inter-RAT E-UTRAN TDD RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the E-UTRAN TDD carrier frequency f1 and the E-UTRAN TDD carrier frequency f2 respectively. | | |

The requirements in this section shall apply for all TDD special subframe configurations specified in TS 36.211 [23] and for the TDD uplink-downlink configurations as specified in Table 9.4.4.2.2-2 for UE requiring measurement gaps for these measurements. For UEs capable of performing inter-RAT RSTD measurements without measurement gaps, TDD uplink-downlink subframe configurations as specified in Table 9.4.4.2.2-3 shall apply.

**Table 9.4.4.2.2-2: TDD uplink-downlink subframe configurations applicable for inter-RAT RSTD requirements**

| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
|---|---|
| 6, 15 | 3, 4 and 5 |
| 25 | 1, 2, 3, 4, 5 and 6 |
| 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| NOTE 1: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [23]. | |

**Table 9.4.4.2.2-3: TDD uplink-downlink subframe configurations applicable for inter-RAT RSTD requirements without gaps**

| PRS Transmission Bandwidth [RB] | Applicable TDD uplink-downlink configurations |
|---|---|
| 6, 15 | 1, 2, 3, 4 and 5 |
| 25, 50, 75, 100 | 0, 1, 2, 3, 4, 5 and 6 |
| NOTE: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [23]. | |

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within $\mathrm{T}_{\mathrm{RSTD\ InterRAT,\ E\text{-}UTRAN\ TDD}}$ provided:

$\left(\mathrm{PRS}\ \hat{\mathrm{E}}_{\mathrm{s}} / \mathrm{Iot}\right)_{ref}$ ≥-6 dB for all Frequency Bands for the reference cell,

$\left(\mathrm{PRS}\ \hat{\mathrm{E}}_{\mathrm{s}} / \mathrm{Iot}\right)_{i}$ ≥-13 dB for all Frequency Bands for neighbour cell *i*,

$\left(\mathrm{PRS}\ \hat{\mathrm{E}}_{\mathrm{s}} / \mathrm{Iot}\right)_{ref}$ and $\left(\mathrm{PRS}\ \hat{\mathrm{E}}_{\mathrm{s}} / \mathrm{Iot}\right)_{i}$ conditions apply for all subframes of at least $L = \frac{M}{2}$ PRS positioning occasions,

PRP 1,2$|_{\mathrm{dBm}}$ according to TS 36.133 [15, Annex B.2.6] for a corresponding Band

$\mathrm{PRS}\ \hat{\mathrm{E}}_{\mathrm{s}} / \mathrm{Iot}$ is as defined in Section 9.4.4.1.2.

The time $\mathrm{T}_{\mathrm{RSTD\ InterRAT,\ E\text{-}UTRAN\ TDD}}$ starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message via LPP as specified in TS 38.305 [22], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in Section 10.2.4.

###### 9.4.4.2.2.1 RSTD Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x $\mathrm{TTI}_{\mathrm{DCCH}}$ where $\mathrm{TTI}_{\mathrm{DCCH}}$ is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

###### 9.4.4.2.2.2 Requirements for acquiring the timing of the E-UTRA OTDOA reference cell

When the UE is not aware of the SFN of at least one LTE cell in the OTDOA assistance data, the UE supporting per-FR gaps may make autonomous gaps in downlink reception and uplink transmission of the PCell and each of the SCells in FR1 for acquiring SFN of the reference cell in the E-UTRA OTDOA assistance data. No autonomous gaps in downlink reception or uplink transmission are allowed in any of the UE serving cells in FR2. The UE, which are only supporting per-UE gaps, may make autonomous gaps in downlink reception and uplink transmission of the PCell and each of the SCells for acquiring the SFN of the reference cell in the E-UTRA OTDOA assistance data.

When the UE is not aware of and cannot derive the subframe timing difference between the NR serving cell and the OTDOA assistance data reference cell, the UE may request measurement gaps for detecting the reference cell in the E-UTRA OTDOA assistance data.

When the UE is performning one or both of SFN acquisition or cell detection as specified above, the UE shall be able to determine the timing of the E-UTRA OTDOA assistance data reference cell during the time period

$$\mathrm{T}_{\mathrm{RefCell,E\text{-}UTRAN}} = \mathrm{T}_{\mathrm{Detect,\ E\text{-}UTRAN\ TDD}} + \mathrm{T}_{\mathrm{MIB}}\ ,$$

where

$\mathrm{T}_{\mathrm{Detect,\ E\text{-}UTRAN\ FDD}}$ = TBD and it is the time needed to detect the E-UTRA OTDOA assistance data reference cell when the UE needs to acquire the subframe and slot timing of the cell ($\mathrm{T}_{\mathrm{Detect,\ E\text{-}UTRAN\ FDD}}$=0 when both *nr-LTE-SFN-Offset* and *nr-LTE-fineTiming-Offset* are provded in the E-UTRA OTDOA assistance data), and

$\mathrm{T}_{\mathrm{MIB}}$ = 50 ms is the time required to acquire SFN of the E-UTRA OTDOA assistance data reference cell provided the OTDOA assistance data reference cell is decodable and at least all E-UTRA subframes #0 during $\mathrm{T}_{\mathrm{MIB}}$ are available at the UE receiver ($\mathrm{T}_{\mathrm{MIB}}$=0 when *nr-LTE-SFN-Offset* is provded in the E-UTRA OTDOA assistance data).

When detecting the E-UTRAN OTDOA reference cell, the requirements in this section are met, provided the conditions for the detectable cell are fulfilled according to Section 9.4.3.1. In addition, the MIB of an E-UTRA cell whose SFN is acquired shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to TS 36.101 [25].

The requirement for acquiring the timing of the E-UTRA OTDOA reference cell within $T_{RefCell,E-UTRAN}$ is applicable when no DRX is used as well as when any of the DRX cycles specified in TS 38.331 [2] is used.Within the timing acquisition time period, $T_{RefCell,E-UTRAN}$, when using autonomous gaps the UE shall transmit at least $N_{ACK/NACK,\ TDD,\ FR1}$ ACK/NACKs on PCell in FR1 or each of activated SCell(s) in the same frequency range, specified in Table 9.4.4.2.2.2-1, provided that:

- there is continuous DL data allocation,
- no DRX cycle is used,
- no measurement gaps are configured,
- only one code word is transmitted in each slot,
- [2] slot ACK/NACK feedback is configured.

**Table 9.4.4.2.2.2-1: Minimum number of ACK/NACKs transmitted by the UE during $T_{MIB}$**

| $N_{ACK/NACK,\ TDD,\ FR1}$ | Configuration of the serving cell in which the transmitted ACK/NACKs are counted | | |
|---|---|---|---|
| | Duplex mode configuration | SCS | SMTC period |
| [TBD] | FDD | 15 kHz | 10 |
| [TBD] | FDD | 15 kHz | 20 |
| [TBD] | FDD | 15 kHz | 40 |
| [TBD] | FDD | 30 kHz | 10 |
| [TBD] | FDD | 30 kHz | 20 |
| [TBD] | FDD | 30 kHz | 40 |
| [TBD] | FDD | 60 kHz | 10 |
| [TBD] | FDD | 60 kHz | 20 |
| [TBD] | FDD | 60 kHz | 40 |
| [TBD] | TDD Note 1 | 15 kHz | 10 |
| [TBD] | TDD Note 1 | 15 kHz | 20 |
| [TBD] | TDD Note 1 | 15 kHz | 40 |
| [TBD] | TDD Note 1 | 30 kHz | 10 |
| [TBD] | TDD Note 1 | 30 kHz | 20 |
| [TBD] | TDD Note 1 | 30 kHz | 40 |
| [TBD] | TDD Note 1 | 60 kHz | 10 |
| [TBD] | TDD Note 1 | 60 kHz | 20 |
| [TBD] | TDD Note 1 | 60 kHz | 40 |
| NOTE: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. | | | |

# 9.4.5 SA: Inter-RAT E-CID measurements

## 9.4.5.1 NR−E-UTRAN FDD E-CID RSRP and RSRQ measurements

### 9.4.5.1.1 Introduction

The requirements in Section 9.4.5.1. shall apply provided the UE has received *ECID-RequestLocationInformation* message from LMF via LPP requesting the UE to report inter-RAT E-UTRAN FDD E-CID RSRP and RSRQ measurements [22].

### 9.4.5.1.2 Requirements

The requirements in Section 9.4.2 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in Section 9.4.5.1.3.

### 9.4.5.1.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x $TTI_{DCCH}$ where $TTI_{DCCH}$ is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in Sections 10.2.2 and 10.2.3, respectively.

#### 9.4.5.2 NR−E-UTRAN TDD E-CID RSRP and RSRQ measurements

##### 9.4.5.2.1 Introduction

The requirements in Section 9.4.5.2. shall apply provided the UE has received *ECID-RequestLocationInformation* message from LMF via LPP requesting the UE to report inter-RAT E-UTRAN TDD E-CID RSRP and RSRQ measurements [22].

##### 9.4.5.2.2 Requirements

The requirements in Section 9.4.3 also apply for this section except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in Section 9.4.5.2.3.

##### 9.4.5.2.3 Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x $TTI_{DCCH}$ where $TTI_{DCCH}$ is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in Sections 10.2.2 and 10.2.3, respectively.

# 9.5 L1-RSRP measurements for Reporting

## 9.5.1 Introduction

When configured by the PCell or the PSCell, the UE shall be able to measure SSB, CSI-RS or both and perform L1-RSRP measurements of configured CSI-RS, SSB or CSI-RS and SSB resources for L1-RSRP. The measurements shall be performed on the resources configured for L1-RSRP measurements within the active BWP.

The UE shall be able to measure all CSI-RS resources and or SSB resources of the CSI Resource set(s) within the CSI Resource settings configured for the active BWP.

Unless the reporting quantity is set to 'none' in a CSI-RS resource, the UE shall report the quantity for the CSI reporting configuration associated by the reporting quantity.

## 9.5.2 Requirements applicability

The requirements in Section 9.5 apply, provided:

- The CSI-RS or SSB or CSI-RS and SSB resources configured for L1-RSRP measurements measurable.

An CSI-RS and/or SSB resource configured for L1-RSRP shall be considered measurable when for each relevant CSI-RS and/or SSB:

- L1-RSRP related side conditions given in Sections 10.x.x for a corresponding Band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding Band.

Requirements are defined for periodic, semi-persistent and aperiodic resources.

## 9.5.3 Measurement Reporting Requirements

The UE shall only send L1-RSRP reports for report configurations configured for the active BWP.

The UE shall report the L1-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1dB step size according to section 10.1.x if *nrofReportedRS* is configured to one. Otherwise, and additionally if *groupBasedBeamReporting* is enabled the UE shall use differential L1-RSRP based reporting as defined in section 10.1.x.

#### 9.5.3.1 Periodic Reporting

Reported L1-RSRP measurements contained in periodic L1-RSRP reports shall meet the requirements in sections 10.x, 10.y and 10.z, respectively.

The UE shall not send any periodic L1-RSRP reports for a non-active BWP.

The L1-RSRP reporting delay is FFS.

The periodic L1-RSRP reporting delay shall be less than [TBD].

#### 9.5.3.2 Semi-Persistent Reporting

Reported L1-RSRP measurements contained in Semi-Persistent L1-RSRP reports shall meet the requirements in sections 10.x, 10.y and 10.z, respectively. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

The UE shall not send any semi-persistent L1-RSRP reports on PUSCH, as long as no DCI request have been received.

The UE shall not send any semi-persistent L1-RSRP reports on PUCCH, as long as no activation command [38.321] have been received.

The L1-RSRP reporting delay is defined as the time between a request or command that will trigger an L1-RSRP report is received by the UE and the point when the UE starts to transmit the L1-RSRP report over the air interface.

The Semi-persistent L1-RSRP reporting delay shall be less than [TBD] for a DCI requsted semi-persistent L1-RSRP report and less than [TBD] for an L1-RSRP requested by activation command [36.321].

#### 9.5.3.3 Aperiodic Reporting

Reported L1-RSRP measurements contained in Aperiodic triggered, Aperiodic triggered periodic and Aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in sections 10.x, 10.y and 10.z, respectively.

The UE shall not send any aperiodic L1-RSRP reports, as long as no DCI trigger have been received.

The L1-RSRP reporting delay is defined as the time between a DCI request that will trigger an L1-RSRP report and the point when the UE starts to transmit the L1-RSRP report over the air interface.

The aperiodic L1-RSRP reporting delay shall be less than [TBD].

### 9.5.4 L1-RSRP measurement requirements

#### 9.5.4.1 SSB based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{BM\_Measurement\_Period\_SSB}$.

The value of $T_{BM\_Measurement\_Period\_SSB}$ is defined in Table 9.5.4.1-1 for FR1 with M=TBD.

The value of $T_{BM\_Measurement\_Period\_SSB}$ is defined in Table 9.5.4.1-2 for FR2 with M=TBD and N=TBD.

Note: for SSB based L1-RSRP measurement, N=1 does not apply.

For FR1,

- $P=1/(1 – T_{SSB}/MGRP)$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB; and

- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- $P=1/(1 – T_{SSB}/T_{SMTCperiod})$, when BM-RS is not overlapped with measurement gap and BM-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).

- P is $P_{sharing\ factor}$, when BM-RS is not overlapped with measurement gap and BM-RS is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).

- P is 1/(1- $T_{SSB}$/MGRP - $T_{SSB}/T_{SMTCperiod}$), when BM-RS is partially overlapped with measurement gap and BM-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and

  - $T_{SMTCperiod} \neq$ MGRP or

  - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5*T_{SMTCperiod}$

- P is 1/(1- $T_{SSB}$ /MGRP)* $P_{sharing\ factor}$, when BM-RS is partially overlapped with measurement gap and BM-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5*T_{SMTCperiod}$

- P is 1/{1- $T_{SSB}$ /min ($T_{SMTCperiod}$ ,MGRP)}, when BM-RS is partially overlapped with measurement gap ($T_{SSB}$ <MGRP) and BM-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.

- P is 1/(1- $T_{SSB}$ /MGRP)* $P_{sharing\ factor}$, when BM-RS is partially overlapped with measurement gap and BM-RS is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)

- $P_{sharing\ factor}$ = 3.

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*.

Longer evaluation period would be expected if the combination of BM-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

Editor's Note: FFS what evaluation period would be expected if BM-RS are in the same OFDM symbols with RLM/BFD/CBD-RS, or other BM-RS.

**Table 9.5.4.1-1: Measurement period $T_{BM\_Measurement\_Period\_SSB}$ for FR1**

| Configuration | $T_{BM\_Measurement\_Period\_SSB}$ (ms) |
|---|---|
| non-DRX | max($T_{Report}$, ceil(M*P)*$T_{SSB}$) |
| DRX cycle ≤ 320ms | max($T_{Report}$, ceil(1.5*M*P)*max($T_{DRX}$,$T_{SSB}$)) |
| DRX cycle > 320ms | ceil(M*P)*$T_{DRX}$ |
| Note: $T_{SSB}$ is the periodicity of SSB configured for L1-RSRP measurement. $T_{DRX}$ is the DRX cycle length. $T_{Report}$ is configured periodicity for reporting. | |

**Table 9.5.4.1-2: Measurement period $T_{BM\_Measurement\_Period\_SSB}$ for FR2**

| Configuration | $T_{BM\_Measurement\_Period\_SSB}$ (ms) |
|---|---|
| non-DRX | max($T_{Report}$, ceil(M*P*N)*$T_{SSB}$) |
| DRX cycle ≤ 320ms | max($T_{Report}$, ceil(1.5*M*P*N)*max($T_{DRX}$,$T_{SSB}$)) |
| DRX cycle > 320ms | ceil(1.5*M*P*N)*$T_{DRX}$ |
| Note: $T_{SSB}$ is the periodicity of SSB configured for L1-RSRP measurement. $T_{DRX}$ is the DRX cycle length. $T_{Report}$ is configured periodicity for reporting. | |

### 9.5.4.2 CSI-RS based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured CSI-RS resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{BM\_Measurement\_Period\_CSI-RS}$.

The value of $T_{BM\_Measurement\_Period\_CSI-RS}$ is defined in Table 9.5.4.2-1 for FR1 with

- M=TBD for measurement on periodic and semi-persistent CSI-RS resources

- M=1 for aperiodic CSI-RS resources

The value of $T_{BM\_Measurement\_Period\_CSI-RS}$ is defined in Table 9.5.4.2-2 for FR2 with

- M=TBD and N=TBD for measurement on periodic and semi-persistent CSI-RS resources
- M=1 and N=1 for aperiodic CSI-RS resources

For FR1,

- P=1/(1 – $T_{CSI-RS}$/MGRP), when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and
- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P=1, when BM-RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- P=1/(1 – $T_{CSI-RS}$/MGRP) , when BM-RS is partially overlapped with measurement gap and BM-RS is not overlapped with SMTC occasion ($T_{CSI-RS}$ < MGRP)
- P=1/(1 – $T_{CSI-RS}$ /$T_{SMTCperiod}$), when BM-RS is not overlapped with measurement gap and BM-RS is partially overlapped with SMTC occasion ($T_{CSI-RS}$ < $T_{SMTCperiod}$).
- P is $P_{sharing\ factor}$, when BM-RS is not overlapped with measurement gap and BM-RS is fully overlapped with SMTC occasion ($T_{CSI-RS}$ = $T_{SMTCperiod}$).
- P is 1/(1- $T_{CSI-RS}$ /MGRP - $T_{CSI-RS}$ /$T_{SMTCperiod}$), when BM-RS is partially overlapped with measurement gap and BM-RS is partially overlapped with SMTC occasion (TCSI-RS < $T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod}$ ≠ MGRP or
  - $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS}$ < 0.5*$T_{SMTCperiod}$
- P is 1/(1- $T_{CSI-RS}$ /MGRP)* $P_{sharing\ factor}$, when BM-RS is partially overlapped with measurement gap and BM-RS is partially overlapped with SMTC occasion ($T_{CSI-RS}$ < $T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS}$ = 0.5*$T_{SMTCperiod}$
- P is 1/{1- $T_{CSI-RS}$ /min ($T_{SMTCperiod}$ ,MGRP)}, when BM-RS is partially overlapped with measurement gap ($T_{CSI-RS}$ < MGRP) and BM-RS is partially overlapped with SMTC occasion ($T_{CSI-RS}$ < $T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.
- P is 1/(1- $T_{CSI-RS}$ /MGRP)* $P_{sharing\ factor}$, when BM-RS is partially overlapped with measurement gap and BM-RS is fully overlapped with SMTC occasion ($T_{CSI-RS}$ = $T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)
- $P_{sharing\ factor}$ is 3**.**

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*.

Note: The overlap between CSI-RS for L1-RSRP measurement and SMTC means that CSI-RS for L1-RSRP measurement is within the SMTC window duration.

Longer evaluation period would be expected if the combination of BM-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

Editor's Note: FFS what evaluation period would be expected if BM-RS are in the same OFDM symbols with RLM/BFD/CBD-RS, or other BM-RS.

**Table 9.5.4.2-1: Measurement period $T_{BM\_Measurement\_Period\_CSI-RS}$ for FR1**

| Configuration | $T_{BM\_Measurement\_Period\_CSI-RS}$ (ms) |
|---|---|
| non-DRX | max($T_{Report}$, ceil(M*P)*$T_{CSI-RS}$) |
| DRX cycle ≤ 320ms | max($T_{Report}$, ceil(1.5*M*P)*max($T_{DRX}$,$T_{CSI-RS}$)) |
| DRX cycle > 320ms | ceil(M*P)*$T_{DRX}$ |
| Note 1: $T_{CSI-RS}$ is the periodicity of CSI-RS configured for L1-RSRP measurement. $T_{DRX}$ is the DRX cycle length. $T_{Report}$ is configured periodicity for reporting.<br>Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3. | |

**Table 9.5.4.2-2: Measurement period $T_{BM\_Measurement\_Period\_CSI-RS}$ for FR2**

| Configuration | $T_{BM\_Measurement\_Period\_CSI-RS}$ (ms) |
|---|---|
| non-DRX | max($T_{Report}$, ceil(M*P*N)*$T_{CSI-RS}$) |
| DRX cycle ≤ 320ms | max($T_{Report}$, ceil(1.5*M*P*N)*max($T_{DRX}$,$T_{CSI-RS}$)) |
| DRX cycle > 320ms | ceil(M*P*N)*$T_{DRX}$ |
| Note 1: $T_{CSI-RS}$ is the periodicity of CSI-RS configured for L1-RSRP measurement. $T_{DRX}$ is the DRX cycle length. $T_{Report}$ is configured periodicity for reporting.<br>Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3. | |

## 9.5.5 Measurement restriction for CSI-RS and SSB for L1-RSRP measurement

The UE is required to be capable of measuring CSI-RS for L1-RSRP without measurement gaps. The UE is required to perform the CSI-RS measurements as described in the following clauses.

### 9.5.5.1 UE performing CSI-RS measurements with a same subcarrier spacing as SSB on FR1

When the SSB is within the active BWP and has same SCS than CSI-RS, the UE shall be able to perform CSI-RS measurement without restrictions when CSI-RS measurement are performed with same subcarrier spacing as the SSB on FR1.

### 9.5.5.2 CSI-RS measurement restrictions of UE performing CSI-RS measurements with a different subcarrier spacing than SSB on FR1

When the SSB is within the active BWP and has different SCS than CSI-RS, the UE shall be able to performs CSI-RS measurement with restrictions according to its capabilities:

- If CSI-RS and SSB are FDM'ed. the UE measurement capability depends on the whether the UE supports *simultaneousRxDataSSB-DiffNumerology*.
  - If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to performs CSI-RS measurement without restrictions assuming *useServingCellTimingForSync* is enabled.
  - If the UE does not support *simultaneousRxDataSSB-DiffNumerology* the UE is not expected to perform simultaneous FDM'ed SSB and CSI-RS measurements,
- If CSI-RS and SSB are TDM'ed, the UE shall be able to performs CSI-RS measurement with restrictions: the UE is not expected to measure CSI-RS on symbols on 1 data symbol before each consecutive SSB symbols and 1 data symbol after each consecutive SSB symbols within the SMTC window duration.

## 9.5.6 Scheduling availability of UE during L1-RSRP measurement

Scheduling availability restrictions when the UE is performing L1-RSRP measurement are described in the following clauses.

#### 9.5.6.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as RS for L1-RSRP measurement with the same SCS as PDSCH/PDCCH in FR1.

#### 9.5.6.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as RS for L1-RSRP measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured as RS for L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on SSB symbols to be measured for L1-RSRP measurement.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions apply to all SCells that are aggregated in the same band as the PCell or PSCell. When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which PCell or PSCell is configured.

#### 9.5.6.3 Scheduling availability of UE performing L1-RSRP measurement on FR2

The following scheduling restriction applies due to L1-RSRP measurement.

- For the case where RS for L1-RSRP measurement is QCLed with active TCI state for PDCCH/PDSCH, and N=1 applies for the RS for L1-RSRP measurement as specified in section 9.4.5.1 if the reference signal is SSB and in section9.4.5.2 if the reference signal is CSI-RS
    - There are no scheduling restrictions due to L1-RSRP measurement performed based on SSB or CSI-RS with a same SCS as PDSCH/PDCCH.
    - When performing L1-RSRP measurement based on SSB with a different SCS than PDSCH/PDCCH, for UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on SSB symbols to be measured for L1-RSRP measurement.
- Otherwise
    - The UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on RS for L1-RSRP measurement symbols to be measured for L1-RSRP measurement.

When intra-band carrier aggregation is performed, the scheduling restrictions apply to all serving cells on the band due to L1-RSRP measurement performed on FR2 PCell or PSCell in the same band.

Editor's Note: FFS scheduling restrictions for inter-band carrier aggregation will be defined depending on band combination in future.

#### 9.5.6.4 Scheduling availability of UE performing L1-RSRP measurement on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to L1-RSRP measurement performed on FR2 serving PCell and/or PSCell.

There are no scheduling restrictions on FR2 serving cell(s) due to L1-RSRP measurement performed on FR1 serving PCell and/or PSCell.

# 10 Measurement Performance requirements

Editor's note: Accuracy requirement might be an individual top-level chapter to maintain since it is the performance part.

# 10.1 NR measurements

## 10.1.1 Introduction

*Editor's note: new measurement metrics may be added according to the RAN4 discussion. Absolute/relative accuracy requirement, mapping table of RSRP/RSRQ may be specified in this section. The numerology and BW combinations might be reflected in the accuracy requirement table.*

In the requirements of Section 10.1, the exceptions for side conditions apply as follows:

- for the UE capable of CA but not configured with any SCell, the applicable exceptions for side conditions are specified in Annex B, Section B.3.2.1 for UE supporting CA in FR1, and Section B.3.2.3 for UE supporting CA in FR2, respectively;
- for the UE capable of CA and configured with at least one SCell, the applicable exceptions for side conditions are specified in Annex B, Section B.3.2.2 for UE configured with CA in FR1, and Section B.3.2.4 for UE supporting CA in FR2 respectively;
- for the UE capable of SUL but not configured with SUL, the applicable exceptions for side conditions are specified in Annex B, Section B.3.4.1 for UE supporting SUL in FR1;
- for the UE capable of SUL and configured with at least one SUL, the applicable exceptions for side conditions are specified in Annex B, Section B.3.4.2 for UE configured with SUL in FR1.

## 10.1.2 Intra-frequency RSRP accuracy requirements for FR1

### 10.1.2.1 Intra-frequency SS-RSRP accuracy requirements

#### 10.1.2.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SS-RSRP in this clause apply to a cell on the same frequency as that of the serving cell in FR1.

The accuracy requirements in Table 10.1.2.1.1-1 are valid under the following conditions:

- Conditions defined in 38.101-1 [18] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.
- Other conditions are TBD.

**Table 10.1.2.1.1-1: SS-RSRP Intra frequency absolute accuracy in FR1**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot | Io Note 1 range | | | | |
| | | | NR operating band groups Note 2 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{SSB}$ | | $dBm/BW_{Channel}$ | $dBm/BW_{Channel}$ |
| | | | | $SCS_{SSB}$ = 15 kHz | $SCS_{SSB}$ = 30 kHz | | |
| ±4.5 | ±9 | ≥-6 dB | NR_FDD_FR1_A, NR_TDD_FR1_A | -121 | -118 | N/A | -70 |
| | | | NR_FDD_FR1_B | -120.5 | -117.5 | N/A | -70 |
| | | | NR_TDD_FR1_C | -120 | -117 | N/A | -70 |
| | | | NR_FDD_FR1_D, NR_TDD_FR1_D | -119.5 | -116.5 | N/A | -70 |
| | | | NR_FDD_FR1_E, NR_TDD_FR1_E | -119 | -116 | N/A | -70 |
| | | | NR_FDD_FR1_G | -118 | -115 | N/A | -70 |
| | | | NR_FDD_FR1_H | -117.5 | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥-6 dB | ANR_FDD_FR1_A, NR_TDD_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_G, NR_FDD_FR1_H, | N/A | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in Section 3.5.2. | | | | | | | |

### 10.1.2.1.2 Relative SS-RSRP Accuracy

The relative accuracy of SS-RSRP is defined as the SS-RSRP measured from one cell compared to the SS-RSRP measured from another cell on the same frequency, or between any two SS RSRP levels measured on the same cell in FR1.

The accuracy requirements in Table 10.1.2.1.2-1 are valid under the following conditions:

- Conditions defined in 38.101-1 [18] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.
- Other conditions are TBD.

**Table 10.1.2.1.2-1: SS-RSRP Intra frequency relative accuracy in FR1**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot Note 2 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 4 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{SSB}$ | | $dBm/BW_{Channel}$ | $dBm/BW_{Channel}$ |
| | | | | $SCS_{SSB}$ = 15 kHz | $SCS_{SSB}$ = 30 kHz | | |
| ±2 | ±3 | ≥-3 dB | NR_FDD_FR1_A, NR_TDD_FR1_A | -121 | -118 | N/A | -50 |
| | | | NR_FDD_FR1_B | -120.5 | -117.5 | N/A | -50 |
| | | | NR_TDD_FR1_C | -120 | -117 | N/A | -50 |
| | | | NR_FDD_FR1_D, NR_TDD_FR1_D | -119.5 | -116.5 | N/A | -50 |
| | | | NR_FDD_FR1_E, NR_TDD_FR1_E | -119 | -116 | N/A | -50 |
| | | | NR_FDD_FR1_G | -118 | -115 | N/A | -50 |
| | | | NR_FDD_FR1_H | -117.5 | -114.5 | N/A | -50 |
| ±3 | ±3 | ≥-6 dB | Note 3 | Note 3 | Note 3 | N/A | Note 3 |

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: NR operating band groups in FR1 are as defined in Section 3.5.2.

#### 10.1.2.2 Intra-frequency [CSI-RS RSRP] accuracy requirements

## 10.1.3 Intra-frequency RSRP accuracy requirements for FR2

### 10.1.3.1 Intra-frequency SS-RSRP accuracy requirements

#### 10.1.3.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SS-RSRP in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in Table 10.1.3.1.1-1 are valid under the following conditions:

- Conditions defined in 38.101-2 [19] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.
- Other conditions are TBD.

**Table 10.1.3.1.1-1: SS-RSRP Intra frequency absolute accuracy in FR2**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot | Io Note 1 range | | | | |
| | | | NR operating band groups Note 2 | Minimum Io | | | Maximum Io |
| | | | | dBm / $SCS_{SSB}$ | | dBm/$BW_{Channel}$ | dBm/$BW_{Channel}$ |
| dB | dB | dB | | $SCS_{SSB}$ = 120kHz | $SCS_{SSB}$ = 240kHz | | |
| ±[6] | ±[9] | TBD | NR_TDD_FR2_A | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_B | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_F | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_G | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_T | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_Y | TBD | TBD | N/A | -70 |
| ±[8] | ±[11] | TBD | TNR_TDD_FR2_A, NR_TDD_FR2_B, NR_TDD_FR2_F, NR_TDD_FR2_G, NR_TDD_FR2_T, NR_TDD_FR2_Y | N/A | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.<br>NOTE 2: NR operating band groups in FR2 are as defined in Section 3.5.3. | | | | | | | |

### 10.1.3.1.2 Relative SS-RSRP Accuracy

The relative accuracy of SS-RSRP is defined as the SS-RSRP measured from one cell compared to the SS-RSRP measured from another cell on the same frequency, or between any two SS RSRP levels measured on the same cell in FR2.

The accuracy requirements in Table 10.1.3.1.2-1 are valid under the following conditions:

- Conditions defined in 38.101-2 [19] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.
- Other conditions are TBD.

**Table 10.1.3.1.2-1: SS-RSRP Intra frequency relative accuracy in FR2**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot Note 2 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 3 | Minimum Io | | | Maximum Io |
| | | | | dBm / $SCS_{SSB}$ | | dBm/$BW_{Channel}$ | dBm/$BW_{Channel}$ |
| dB | dB | dB | | $SCS_{SSB}$ = 120kHz | $SCS_{SSB}$ = 240kHz | | |
| ±[6] | ±[9] | TBD | NR_TDD_FR2_A | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_B | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_F | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_G | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_T | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_Y | TBD | TBD | N/A | TBD |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.<br>NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.<br>NOTE 3: NR operating band groups in FR2 are as defined in Section 3.5.3. | | | | | | | |

### 10.1.3.2 Intra-frequency [CSI-RS RSRP] accuracy requirements

## 10.1.4 Inter-frequency RSRP accuracy requirements for FR1

### 10.1.4.1 Inter-frequency SS-RSRP accuracy requirements

#### 10.1.4.1.1 Absolute Accuracy of SS-RSRP in FR1

The requirements for absolute accuracy of SS-RSRP in this clause apply to a cell on a frequency in FR1 that has different carrier frequency from the serving cell.

The accuracy requirements in Table 10.1.4.1.1-1 are valid under the following conditions:

- Conditions defined in 38.101-1 [18] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- Other conditions are TBD.

**Table 10.1.4.1.1-1: SS-RSRP Inter frequency Absolute accuracy in FR1**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot Note 2 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 3 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{SSB}$ | | dBm/$BW_{Channel}$ | dBm/$BW_{Channel}$ |
| | | | | $SCS_{SSB}$ = 15 kHz | $SCS_{SSB}$ = 30 kHz | | |
| ±4.5 | ±6 | ≥[-6] dB | NR_FDD_FR1_A, NR_TDD_FR1_A | -121 | -118 | N/A | -70 |
| | | | NR_FDD_FR1_B | -120.5 | -117.5 | N/A | -70 |
| | | | NR_TDD_FR1_C | -120 | -117 | N/A | -70 |
| | | | NR_FDD_FR1_D, NR_TDD_FR1_D | -119.5 | -116.5 | N/A | -70 |
| | | | NR_FDD_FR1_E, NR_TDD_FR1_E | -119 | -116 | N/A | -70 |
| | | | NR_FDD_FR1_G | -118 | -115 | N/A | -70 |
| | | | NR_FDD_FR1_H | -117.5 | -114.5 | N/A | -70 |
| ±8 | ±11 | ≥[-6] dB | NR_FDD_FR1_A, NR_TDD_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_G, NR_FDD_FR1_H, | N/A | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.<br>NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.<br>NOTE 3: NR operating band groups in FR1 are as defined in Section 3.5.2. | | | | | | | |

#### 10.1.4.1.2 Relative Accuracy of SS-RSRP in FR1

The relative accuracy of SS-RSRP in inter frequency case is defined as the RSRP measured from one cell on a frequency in FR1compared to the RSRP measured from another cell on a different frequency in FR1.

The accuracy requirements in Table 10.1.4.1.2-1 are valid under the following conditions:

- Conditions defined in 38.101-1 [18] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.

- $\left| RSRP1|_{dBm} - RSRP2|_{dBm} \right| \leq 27dB$

- | Channel 1_Io -Channel 2_Io | ≤ 20 dB

- Other conditions are TBD.

**Table 10.1.4.1.2-1: SS-RSRP Inter frequency relative accuracy in FR1**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot Note 2 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 3 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{SSB}$ | | dBm/$BW_{Channel}$ | dBm/$BW_{Channel}$ |
| | | | | $SCS_{SSB}$ = 15 kHz | $SCS_{SSB}$ = 30 kHz | | |
| ±4.5 | ±6 | ≥[-6] dB | NR_FDD_FR1_A, NR_TDD_FR1_A | -121 | -118 | N/A | -50 |
| | | | NR_FDD_FR1_B | -120.5 | -117.5 | N/A | -50 |
| | | | NR_TDD_FR1_C | -120 | -117 | N/A | -50 |
| | | | NR_FDD_FR1_D, NR_TDD_FR1_D | -119.5 | -116.5 | N/A | -50 |
| | | | NR_FDD_FR1_E, NR_TDD_FR1_E | -119 | -116 | N/A | -50 |
| | | | NR_FDD_FR1_G | -118 | -115 | N/A | -50 |
| | | | NR_FDD_FR1_H | -117.5 | -114.5 | N/A | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.<br>NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.<br>NOTE 3: NR operating band groups in FR1 are as defined in Section 3.5.2. | | | | | | | |

### 10.1.4.2 Inter-frequency [CSI-RS RSRP] accuracy requirements

## 10.1.5 Inter-frequency RSRP accuracy requirementsfor FR2

### 10.1.5.1 Inter-frequency SS-RSRP accuracy requirements

#### 10.1.5.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SS-RSRP in this clause apply to a cell on a frequency in FR2 that is on a different frequency than the serving cell.

The accuracy requirements in Table 10.1.5.1.1-1 are valid under the following conditions:

- Conditions defined in 38.101-2 [19] Clause 7.3 for reference sensitivity are fulfilled.

- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.

- Other conditions are TBD.

**Table 10.1.5.1.1-1: SS-RSRP Inter frequency absolute accuracy in FR2**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot | Io Note 1 range | | | | |
| | | | NR operating band groups Note 2 | Minimum Io | | | Maximum Io |
| | | | | dBm / $SCS_{SSB}$ | | dBm/$BW_{Channel}$ | dBm/$BW_{Channel}$ |
| dB | dB | dB | | $SCS_{SSB}$ = 120kHz | $SCS_{SSB}$ = 240kHz | | |
| ±[6] | ±[9] | TBD | NR_TDD_FR2_A | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_B | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_F | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_G | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_T | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_Y | TBD | TBD | N/A | -70 |
| ±[8] | ±[11] | TBD | TNR_TDD_FR2_A, NR_TDD_FR2_B, NR_TDD_FR2_F, NR_TDD_FR2_G, NR_TDD_FR2_T, NR_TDD_FR2_Y | N/A | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.<br>NOTE 2: NR operating band groups in FR2 are as defined in Section 3.5.3. | | | | | | | |

## 10.1.5.1.2 Relative SS-RSRP Accuracy

The relative accuracy of SS-RSRP is defined as the SS-RSRP measured from one cell on a frequency in FR2 compared to the SS-RSRP measured from another cell on another frequency in FR2.

The accuracy requirements in Table 10.1.5.1.2-1 are valid under the following conditions:

- Conditions defined in 38.101-2 [19] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- $\left| RSRP1|_{dBm} - RSRP2|_{dBm} \right| \le 27dB$
- | Channel 1_Io -Channel 2_Io | ≤ 20 dB
- Other conditions are TBD.

**Table 10.1.5.1.2-1: SS-RSRP Inter frequency relative accuracy in FR2**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot Note 2 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 3 | Minimum Io | | | Maximum Io |
| | | | | dBm / $SCS_{SSB}$ | | dBm/$BW_{Channel}$ | dBm/$BW_{Channel}$ |
| dB | dB | dB | | $SCS_{SSB}$ = 120kHz | $SCS_{SSB}$ = 240kHz | | |
| ±[6] | ±[9] | TBD | NR_TDD_FR2_A | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_B | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_F | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_G | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_T | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_Y | TBD | TBD | N/A | TBD |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.<br>NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.<br>NOTE 3: NR operating band groups in FR2 are as defined in Section 3.5.3. | | | | | | | |

#### 10.1.5.2 Inter-frequency [CSI-RS RSRP] accuracy requirements

### 10.1.6 RSRP Measurement Report Mapping

The reporting range of SS-RSRP for L3 reporting is defined from -156 dBm to -31 dBm with 1 dB resolution. The reporting range of SS-RSRP and CSI-RSRP for L1 reporting is defined from -140 to -40dBm with 1dB resolution.

The mapping of measured quantity is defined in Table 10.1.6.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

The reporting range of differential SS-RSRP and CSI-RSRP for L1 reporting is defined from 0 dBm to -30 dB with 2 dB resolution.

The mapping of measured quantity is defined in Table 10.1.6.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

**Table 10.1.6.1-1: SS-RSRP and CSI-RSRP measurement report mapping**

| Reported value | Measured quantity value(L3 SS-RSRP) | Measured quantity value(L1 SS-RSRP and CSI-RSRP) | Unit |
|---|---|---|---|
| RSRP_0 | SS-RSRP<-156 | Not valid | dBm |
| RSRP_1 | -156≤ SS-RSRP<-155 | Not valid | dBm |
| RSRP_2 | -155≤ SS-RSRP<-154 | Not valid | dBm |
| RSRP_3 | -154≤ SS-RSRP<-153 | Not valid | dBm |
| RSRP_4 | -153≤ SS-RSRP<-152 | Not valid | dBm |
| RSRP_5 | -152≤ SS-RSRP<-151 | Not valid | dBm |
| RSRP_6 | -151≤ SS-RSRP<-150 | Not valid | dBm |
| RSRP_7 | -150≤ SS-RSRP<-149 | Not valid | dBm |
| RSRP_8 | -149≤ SS-RSRP<-148 | Not valid | dBm |
| RSRP_9 | -148≤ SS-RSRP<-147 | Not valid | dBm |
| RSRP_10 | -147≤ SS-RSRP<-146 | Not valid | dBm |
| RSRP_11 | -146≤ SS-RSRP<-145 | Not valid | dBm |
| RSRP_12 | -145≤ SS-RSRP<-144 | Not valid | dBm |
| RSRP_13 | -144≤ SS-RSRP<-143 | Not valid | dBm |
| RSRP_14 | -143≤ SS-RSRP<-142 | Not valid | dBm |
| RSRP_15 | -142≤ SS-RSRP<-141 | Not valid | dBm |
| RSRP_16 | -141≤ SS-RSRP<-140 | RSRP<-140 | dBm |
| RSRP_17 | -140≤ SS-RSRP<-139 | -140≤RSRP<-139 | dBm |
| RSRP_18 | -139≤ SS-RSRP<-138 | -139≤ RSRP<-138 | dBm |
| … | … | | … |
| RSRP_111 | -46≤ SS-RSRP<-45 | -46≤ RSRP<-45 | dBm |
| RSRP_112 | -45≤ SS-RSRP<-44 | -45≤ RSRP<-44 | dBm |
| RSRP_113 | -44≤ SS-RSRP<-43 | -44≤ RSRP | dBm |
| RSRP_114 | -43≤ SS-RSRP<-42 | Not valid | dBm |
| RSRP_115 | -42≤ SS-RSRP<-41 | Not valid | dBm |
| RSRP_116 | -41≤ SS-RSRP<-40 | Not valid | dBm |
| RSRP_117 | -40≤ SS-RSRP<-39 | Not valid | dBm |
| RSRP_118 | -39≤ SS-RSRP<-38 | Not valid | dBm |
| RSRP_119 | -38≤ SS-RSRP<-37 | Not valid | dBm |
| RSRP_120 | -37≤ SS-RSRP<-36 | Not valid | dBm |
| RSRP_121 | -36≤ SS-RSRP<-35 | Not valid | dBm |
| RSRP_122 | -35≤ SS-RSRP<-34 | Not valid | dBm |
| RSRP_123 | -34≤ SS-RSRP<-33 | Not valid | dBm |
| RSRP_124 | -33≤ SS-RSRP<-32 | Not valid | dBm |
| RSRP_125 | -32≤ SS-RSRP<-31 | Not valid | dBm |
| RSRP_126 | -31≤ SS-RSRP | Not valid | dBm |
| RSRP_127 (Note) | Infinity | Infinity | dBm |
| Note: The value of RSRP_127 is applicable for RSRP threshold configured by the network as defined in TS 38.331 [2], but not for the purpose of measurement reporting. | | | |

**Table 10.1.6.1-2:Differential SS-RSRP and CSI-RSRP measurement report mapping**

| Reported value | Measured quantity value(difference in measured RSRP from strongest RSRP) | Unit |
|---|---|---|
| DIFFRSRP_0 | 0≥ΔRSRP>-2 | dB |
| DIFFRSRP_1 | -2≥ΔRSRP>-4 | dB |
| DIFFRSRP_2 | -4≥ΔRSRP>-6 | dB |
| DIFFRSRP_3 | -6≥ΔRSRP>-8 | dB |
| DIFFRSRP_4 | -8≥ΔRSRP>-10 | dB |
| DIFFRSRP_5 | -10≥ΔRSRP>-12 | dB |
| DIFFRSRP_6 | -12≥ΔRSRP>-14 | dB |
| DIFFRSRP_7 | -14≥ΔRSRP>-16 | dB |
| DIFFRSRP_8 | -16≥ΔRSRP>-18 | dB |
| DIFFRSRP_9 | -18≥ΔRSRP>-20 | dB |
| DIFFRSRP_10 | -20≥ΔRSRP>-22 | dB |
| DIFFRSRP_11 | -22≥ΔRSRP>-24 | dB |
| DIFFRSRP_12 | -24≥ΔRSRP>-26 | dB |
| DIFFRSRP_13 | -26≥ΔRSRP>-28 | dB |
| DIFFRSRP_14 | -28≥ΔRSRP>-30 | dB |
| DIFFRSRP_15 | -30≥ΔRSRP | dB |

## 10.1.7 Intra-frequency RSRQ accuracy requirements for FR1

### 10.1.7.1 Intra-frequency SS-RSRQ accuracy requirements in FR1

#### 10.1.7.1.1 Absolute SS-RSRQ Accuracy in FR1

Unless otherwise specified, the requirements for absolute accuracy of SS-RSRQ in this clause apply to a cell on the same frequency as that of the serving cell in FR1.

The accuracy requirements in Table 10.1.7.1.1-1 are valid under the following conditions:

- Conditions defined in 38.101-1 [18] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.
- Other conditions are TBD.

**Table 10.1.7.1.1-1: SS-RSRQ Intra frequency absolute accuracy in FR1**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot | Io Note 1 range | | | | |
| | | | NR operating band groups Note 3 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{SSB}$ | | dBm/$BW_{Channel}$ | dBm/$BW_{Channel}$ |
| | | | | $SCS_{SSB}$ = 15 kHz | $SCS_{SSB}$ = 30 kHz | | |
| ±2.5 | ±4 | ≥-3 dB | NR_FDD_FR1_A, NR_TDD_FR1_A | -121 | -118 | N/A | -50 |
| | | | NR_FDD_FR1_B | -120.5 | -117.5 | N/A | -50 |
| | | | NR_TDD_FR1_C | -120 | -117 | N/A | -50 |
| | | | NR_FDD_FR1_D, NR_TDD_FR1_D | -119.5 | -116.5 | N/A | -50 |
| | | | NR_FDD_FR1_E, NR_TDD_FR1_E | -119 | -116 | N/A | -50 |
| | | | NR_FDD_FR1_G | -118 | -115 | N/A | -50 |
| | | | NR_FDD_FR1_H | -117.5 | -114.5 | N/A | -50 |
| ±3.5 | ±4 | ≥-6 dB | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.<br>NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.<br>NOTE 3: NR operating band groups in FR1 are as defined in Section 3.5.2. | | | | | | | |

## 10.1.8 Intra-frequency RSRQ accuracy requirements for FR2

### 10.1.8.1 Intra-frequency SS-RSRQ accuracy requirements in FR2

#### 10.1.8.1.1 Absolute SS-RSRQ Accuracy in FR2

Unless otherwise specified, the requirements for absolute accuracy of SS-RSRQ in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in Table 10.1.8.1.1-1 are valid under the following conditions:

- Conditions defined in 38.101-2 [19] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.
- Other conditions are TBD.

**Table 10.1.8.1.1-1: SS-RSRQ Intra frequency absolute accuracy in FR2**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot | Io Note 1 range | | | | |
| | | | NR operating band groups Note 3 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{SSB}$ | | $dBm/BW_{Channel}$ | $dBm/BW_{Channel}$ |
| | | | | $SCS_{SSB}$ = 120 kHz | $SCS_{SSB}$ = 240 kHz | | |
| ±[2.5] | ±[4] | ≥[TBD] dB | NR_TDD_FR2_A | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_B | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_F | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_G | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_T | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_Y | TBD | TBD | N/A | -50 |
| ±[3.5] | ±[4] | ≥[TBD] dB | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.<br>NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.<br>NOTE 3: NR operating band groups in FR2 are as defined in Section 3.5.3. | | | | | | | |

# 10.1.9 Inter-frequency RSRQ accuracy requirements for FR1

## 10.1.9.1 Inter-frequency SS-RSRQ accuracy requirements in FR1

### 10.1.9.1.1 Aboslute Accuracy of SS-RSRQ in FR1

The requirements for absolute accuracy of SS-RSRQ in this clause apply to a cell on a frequency in FR1 that has different carrier frequency from the serving cell.

The accuracy requirements in Table 10.1.9.1.1-1 are valid under the following conditions:

- Conditions defined in 38.101-1 [18] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- Other conditions are TBD.

**Table 10.1.9.1.1-1: SS-RSRQ Inter frequency absolute accuracy in FR1**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot | Io Note 1 range | | | | |
| | | | NR operating band groups Note 3 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{SSB}$ | | $dBm/BW_{Channel}$ | $dBm/BW_{Channel}$ |
| | | | | $SCS_{SSB}$ = 15 kHz | $SCS_{SSB}$ = 30 kHz | | |
| ±2.5 | ±4 | ≥[-3] dB | NR_FDD_FR1_A, NR_TDD_FR1_A | -121 | -118 | N/A | -50 |
| | | | NR_FDD_FR1_B | -120.5 | -117.5 | N/A | -50 |
| | | | NR_TDD_FR1_C | -120 | -117 | N/A | -50 |
| | | | NR_FDD_FR1_D, NR_TDD_FR1_D | -119.5 | -116.5 | N/A | -50 |
| | | | NR_FDD_FR1_E, NR_TDD_FR1_E | -119 | -116 | N/A | -50 |
| | | | NR_FDD_FR1_G | -118 | -115 | N/A | -50 |
| | | | NR_FDD_FR1_H | -117.5 | -114.5 | N/A | -50 |
| ±3.5 | ±4 | ≥[-6] dB | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 |

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: NR operating band groups in FR1 are as defined in Section 3.5.2.

### 10.1.9.1.2 Relative Accuracy of SS-RSRQ in FR1

The relative accuracy of SS-RSRQ in inter frequency case is defined as the RSRQ measured from one cell on a frequency in FR1 compared to the RSRP measured from another cell on a different frequency in FR1.

The accuracy requirements in Table 10.1.9.1.2-1 are valid under the following conditions:

- Conditions defined in 38.101-1 [18] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- $\left| RSRP1|_{dBm} - RSRP2|_{dBm} \right| \le 27dB$
- | Channel 1_Io -Channel 2_Io | ≤ 20 dB
- Other conditions are TBD.

**Table 10.1.9.1.2-1: SS-RSRQ Inter frequency relative accuracy in FR1**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot Note 2 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 4 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{SSB}$ | | $dBm/BW_{Channel}$ | $dBm/BW_{Channel}$ |
| | | | | $SCS_{SSB}$ = 15 kHz | $SCS_{SSB}$ = 30 kHz | | |
| ±3 | ±4 | ≥[-3] dB | NRFDD_FR1_A, NRTDD_FR1_A | TBD | TBD | N/A | -50 |
| | | | NRFDD_FR1_B | TBD | TBD | N/A | -50 |
| | | | NRTDD_FR1_C | TBD | TBD | N/A | -50 |
| | | | NRFDD_FR1_E, NRTDD_FR1_E | TBD | TBD | N/A | -50 |
| | | | NRFDD_FR1_G | TBD | TBD | N/A | -50 |
| | | | NRFDD_FR1_H | TBD | TBD | N/A | -50 |
| ±4 | ±4 | ≥[-6] dB | Note 3 | Note 3 | Note 3 | Note 3 | Note 3 |

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: NR operating band groups in FR1 are as defined in Section 3.5.2.

## 10.1.10 Inter-frequency RSRQ accuracy requirements for FR2

### 10.1.10.1 Inter-frequency SS-RSRQ accuracy requirements in FR2

#### 10.1.10.1.1 Aboslute Accuracy of SS-RSRQ in FR2

The requirements for absolute accuracy of SS-RSRQ in this clause apply to a cell on a frequency in FR2 that has different carrier frequency from the serving cell.

The accuracy requirements in Table 10.1.10.1.1-1 are valid under the following conditions:

- Conditions defined in 38.101-2 [19] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- Other conditions are TBD.

**Table 10.1.10.1.1-1: SS-RSRQ Inter frequency absolute accuracy in FR2**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot | Io Note 1 range | | | | |
| | | | NR operating band groups Note 3 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{SSB}$ | | dBm/$BW_{Channel}$ | dBm/$BW_{Channel}$ |
| | | | | $SCS_{SSB}$ = 120 kHz | $SCS_{SSB}$ = 240 kHz | | |
| ±[2.5] | ±[4] | ≥[TBD] dB | NR_TDD_FR2_A | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_B | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_F | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_G | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_T | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_Y | TBD | TBD | N/A | -50 |
| ±[3.5] | ±[4] | ≥[TBD] dB | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.<br>NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.<br>NOTE 3: NR operating band groups in FR2 are as defined in Section 3.5.3. | | | | | | | |

## 10.1.10.1.2 Relative Accuracy of SS-RSRQ in FR2

The relative accuracy of SS-RSRQ in inter frequency case is defined as the RSRQ measured from one cell on a frequency in FR2 compared to the RSRP measured from another cell on a different frequency in FR2.

The accuracy requirements in Table 10.1.10.1.2-1 are valid under the following conditions:

- Conditions defined in 38.101-2 [19] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- $\left| RSRP1|_{dBm} - RSRP2|_{dBm} \right| \le 27dB$
- | Channel 1_Io -Channel 2_Io | ≤ 20 dB
- Other conditions are TBD.

**Table 10.1.10.1.2-1: SS-RSRQ Inter frequency relative accuracy in FR2**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot Note 2 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 4 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{SSB}$ | | dBm/$BW_{Channel}$ | dBm/$BW_{Channel}$ |
| | | | | $SCS_{SSB}$ = 120 kHz | $SCS_{SSB}$ = 240 kHz | | |
| ±[3] | ±[4] | ≥[TBD] dB | NR_TDD_FR2_A | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_B | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_F | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_G | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_T | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_Y | TBD | TBD | N/A | -50 |
| ±[4] | ±[4] | ≥[TBD] dB | Note 3 | Note 3 | Note 3 | Note 3 | Note 3 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.<br>NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.<br>NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.<br>NOTE 4: NR operating band groups in FR2 are as defined in Section 3.5.3. | | | | | | | |

### 10.1.11 RSRQ report mapping

#### 10.1.11.1 SS-RSRQ measurement report mapping

The reporting range of SS-RSRQ is defined from -43 dB to 20 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 10.1.11.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

**Table 10.1.11.1-1: SS-RSRQ measurement report mapping**

| Reported value | Measured quantity value | Unit |
|---|---|---|
| SS-RSRQ_0 | SS-RSRQ<-43 | dB |
| SS-RSRQ_1 | -43≤ SS-RSRQ<-42.5 | dB |
| SS-RSRQ_2 | -42.5≤ SS-RSRQ<-42 | dB |
| SS-RSRQ_3 | -42≤ SS-RSRQ<-41.5 | dB |
| SS-RSRQ_4 | -41.5≤ SS-RSRQ<-41 | dB |
| .. | .. | … |
| SS-RSRQ_122 | 17.5≤ SS-RSRQ<18 | dB |
| SS-RSRQ_123 | 18≤ SS-RSRQ<18.5 | dB |
| SS-RSRQ_124 | 18.5≤ SS-RSRQ<19 | dB |
| SS-RSRQ_125 | 19≤ SS-RSRQ<19.5 | dB |
| SS-RSRQ_126 | 19.5≤ SS-RSRQ<20 | dB |
| SS-RSRQ_127 | 20 ≤ SS-RSRQ | dB |

### 10.1.12 Intra-frequency SINR accuracy requirements for FR1

#### 10.1.12.1 Intra-frequency SS-SINR accuracy requirements in FR1

##### 10.1.12.1.1 Absolute SS-SINR Accuracy in FR1

Unless otherwise specified, the requirements for absolute accuracy of SS-SINR in this clause apply to a cell on the same frequency as that of the serving cell in FR1.

The accuracy requirements in Table 10.1.12.1.1-1 are valid under the following conditions:

- Conditions defined in 38.101-1 [18] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band.
- Other conditions are TBD.

**Table 10.1.12.1.1-1: SS-SINR Intra frequency absolute accuracy in FR1**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot Note 3 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 4 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{SSB}$ | | $dBm/BW_{Channel}$ | $dBm/BW_{Channel}$ |
| | | | | $SCS_{SSB}$ = 15 kHz | $SCS_{SSB}$ = 30 kHz | | |
| ±3.0 | ±4 | ≥-3 dB | NR_FDD_FR1_A, NR_TDD_FR1_A | -121 | -118 | N/A | -50 |
| | | | NR_FDD_FR1_B | -120.5 | -117.5 | N/A | -50 |
| | | | NR_TDD_FR1_C | -120 | -117 | N/A | -50 |
| | | | NR_FDD_FR1_D, NR_TDD_FR1_D | -119.5 | -116.5 | N/A | -50 |
| | | | NR_FDD_FR1_E, NR_TDD_FR1_E | -119 | -116 | N/A | -50 |
| | | | NR_FDD_FR1_G | -118 | -115 | N/A | -50 |
| | | | NR_FDD_FR1_H | -117.5 | -114.5 | N/A | -50 |
| ±3.5 | ±4 | ≥-6 dB | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 |

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: The requirements apply for SSB Ês/Iot ≤ 25 dB.
NOTE 4: NR operating band groups in FR1 are as defined in Section 3.5.2.

## 10.1.13 Intra-frequency SINR accuracy requirements for FR2

### 10.1.13.1 Intra-frequency SS-SINR accuracy requirements in FR2

#### 10.1.13.1.1 Absolute SS-SINR Accuracy in FR2

Unless otherwise specified, the requirements for absolute accuracy of SS-SINR in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in Table 10.1.13.1.1-1 are valid under the following conditions:

- Conditions defined in 38.101-2 [19] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band.
- Other conditions are TBD.

**Table 10.1.13.1.1-1: SS-SINR Intra frequency absolute accuracy in FR2**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot Note 3 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 4 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / SCS_SSB | | dBm/BW_Channel | dBm/BW_Channel |
| | | | | SCS_SSB = 120 kHz | SCS_SSB = 240 kHz | | |
| ±[3.0] | ±[4] | ≥[TBD] dB | NR_TDD_FR2_A | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_B | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_F | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_G | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_T | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_Y | TBD | TBD | N/A | -50 |
| ±[3.5] | ±[4] | ≥[TBD] dB | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 |

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: The requirements apply for SSB Ês/Iot ≤ [25] dB.
NOTE 4: NR operating band groups in FR2 are as defined in Section 3.5.3.

## 10.1.14 Inter-frequency SINR accuracy requirements for FR1

### 10.1.14.1 Inter-frequency SS-SINR accuracy requirements in FR1

#### 10.1.14.1.1 Aboslute Accuracy of SS-SINR in FR1

The requirements for absolute accuracy of SS-SINR in this clause apply to a cell on a frequency in FR1 that has different carrier frequency from the serving cell.

The accuracy requirements in Table 10.1.14.1.1-1 are valid under the following conditions:

- Conditions defined in 38.101-1 [18] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band.
- Other conditions are TBD.

**Table 10.1.14.1.1-1: SS-SINR Inter frequency absolute accuracy in FR1**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot Note 3 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 4 | Minimum Io | | | Maximum Io |
| | | dB | | dBm / $SCS_{SSB}$ | | $dBm/BW_{Channel}$ | $dBm/BW_{Channel}$ |
| dB | dB | | | $SCS_{SSB}$ = 15 kHz | $SCS_{SSB}$ = 30 kHz | | |
| ±3.0 | ±4 | ≥[-3] dB | NR_FDD_FR1_A, NR_TDD_FR1_A | -121 | -118 | N/A | -50 |
| | | | NR_FDD_FR1_B | -120.5 | -117.5 | N/A | -50 |
| | | | NR_TDD_FR1_C | -120 | -117 | N/A | -50 |
| | | | NR_FDD_FR1_D, NR_TDD_FR1_D | -119.5 | -116.5 | N/A | -50 |
| | | | NR_FDD_FR1_E, NR_TDD_FR1_E | -119 | -116 | N/A | -50 |
| | | | NR_FDD_FR1_G | -118 | -115 | N/A | -50 |
| | | | NR_FDD_FR1_H | -117.5 | -114.5 | N/A | -50 |
| ±3.5 | ±4 | ≥[-6] dB | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 |

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: The requirements apply for SSB Ês/Iot ≤ 25 dB.
NOTE 4: NR operating band groups in FR1 are as defined in Section 3.5.2.

### 10.1.14.1.2 Relative Accuracy of SS-SINR in FR1

The relative accuracy of SS-SINR in inter frequency case is defined as the SS-SINR measured from one cell on a frequency in FR1 compared to the SS-SINR measured from another cell on a different frequency in FR1.

The accuracy requirements in Table 10.1.14.1.2-1 are valid under the following conditions:

- Conditions defined in 38.101-1 [18] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band.
- $\left| RSRP1|_{dBm} - RSRP2|_{dBm} \right| \leq 27dB$
- | Channel 1_Io -Channel 2_Io | ≤ 20 dB
- Other conditions are TBD.

**Table 10.1.14.1.2-1: SS-SINR Inter frequency relative accuracy in FR1**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot Note 2,4 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 5 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{SSB}$ | | dBm/$BW_{Channel}$ | dBm/$BW_{Channel}$ |
| | | | | $SCS_{SSB}$ = 120 kHz | $SCS_{SSB}$ = 240 kHz | | |
| [±3.5] | [±4] | ≥[-3] dB | NR_FDD_FR1_A, NR_TDD_FR1_A | -121 | -118 | N/A | -50 |
| | | | NR_FDD_FR1_B | -120.5 | -117.5 | N/A | -50 |
| | | | NR_TDD_FR1_C | -120 | -117 | N/A | -50 |
| | | | NR_FDD_FR1_D, NR_TDD_FR1_D | -119.5 | -116.5 | N/A | -50 |
| | | | NR_FDD_FR1_E, NR_TDD_FR1_E | -119 | -116 | N/A | -50 |
| | | | NR_FDD_FR1_G | -118 | -115 | N/A | -50 |
| | | | NR_FDD_FR1_H | -117.5 | -114.5 | N/A | -50 |
| [±4] | [±4] | ≥[-6] dB | Note 3 | Note 3 | Note 3 | Note 3 | Note 3 |

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: The requirements apply for SSB Ês/Iot ≤ [25] dB.
NOTE 5: NR operating band groups in FR1 are as defined in Section 3.5.2.

## 10.1.15 Inter-frequency SINR accuracy requirements for FR2

### 10.1.15.1 Inter-frequency SS-SINR accuracy requirements in FR2

#### 10.1.15.1.1 Aboslute Accuracy of SS-SINR in FR2

The requirements for absolute accuracy of SS-SINR in this clause apply to a cell on a frequency in FR2 that has different carrier frequency from the serving cell.

The accuracy requirements in Table 10.1.15.1.1-1 are valid under the following conditions:

- Conditions defined in 38.101-2 [19] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band.
- Other conditions are TBD.

**Table 10.1.15.1.1-1: SS-SINR Inter frequency absolute accuracy in FR2**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot Note 3 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 4 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{SSB}$ | | $dBm/BW_{Channel}$ | $dBm/BW_{Channel}$ |
| | | | | $SCS_{SSB}$ = 120 kHz | $SCS_{SSB}$ = 240 kHz | | |
| ±[3.0] | ±[4] | ≥[TBD] dB | NR_TDD_FR2_A | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_B | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_F | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_G | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_T | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_Y | TBD | TBD | N/A | -50 |
| ±[3.5] | ±[4] | ≥[TBD] dB | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 |

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: The requirements apply for SSB Ês/Iot ≤ [25] dB.
NOTE 4: NR operating band groups in FR2 are as defined in Section 3.5.3.

#### 10.1.15.1.2 Relative Accuracy of SS-SINR in FR2

The relative accuracy of SS-SINR in inter frequency case is defined as the SS-SINR measured from one cell on a frequency in FR2 compared to the SS-SINR measured from another cell on a different frequency in FR2.

The accuracy requirements in Table 10.1.15.1.2-1 are valid under the following conditions:

- Conditions defined in 38.101-2 [19] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band.
- $\left| RSRP1|_{dBm} - RSRP2|_{dBm} \right| \le 27dB$
- | Channel 1_Io -Channel 2_Io | ≤ 20 dB
- Other conditions are TBD.

**Table 10.1.15.1.2-1: SS-SINR Inter frequency relative accuracy in FR2**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot Note 2, Note 4 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 5 | Minimum Io | | | Maximum Io |
| | | | | dBm / $SCS_{SSB}$ | | dBm/$BW_{Channel}$ | dBm/$BW_{Channel}$ |
| dB | dB | dB | | $SCS_{SSB}$ = 120 kHz | $SCS_{SSB}$ = 240 kHz | | |
| ±[3.5] | ±[4] | ≥[TBD] dB | NR_TDD_FR2_A | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_B | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_F | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_G | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_T | TBD | TBD | N/A | -50 |
| | | | NR_TDD_FR2_Y | TBD | TBD | N/A | -50 |
| ±[4] | ±[4] | ≥[TBD] dB | Note 3 | Note 3 | Note 3 | Note 3 | Note 3 |

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: The requirements apply for SSB Ês/Iot ≤ [25] dB.
NOTE 5: NR operating band groups in FR2 are as defined in Section 3.5.3.

## 10.1.16 SINR report mapping

### 10.1.16.1 SS-SINR measurement report mapping

The reporting range of SS-SINR is defined from -23 dB to 40 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 10.1.16.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

**Table 10.1.16.1-1: SS-SINR measurement report mapping**

| Reported value | Measured quantity value | Unit |
|---|---|---|
| SS-SINR_0 | SS-SINR<-23 | dB |
| SS-SINR_1 | -23≤ SS-SINR<-22.5 | dB |
| SS-SINR_2 | -22.5≤ SS-SINR<-22 | dB |
| SS-SINR_3 | -22≤ SS-SINR<-21.5 | dB |
| SS-SINR_4 | -21.5≤ SS-SINR<-21 | dB |
| .. | .. | … |
| SS-SINR_123 | 38≤ SS-SINR<38.5 | dB |
| SS-SINR_124 | 38.5≤ SS-SINR<39 | dB |
| SS-SINR_125 | 39≤ SS-SINR<39.5 | dB |
| SS-SINR_126 | 39.5≤ SS-SINR<40 | dB |
| SS-SINR_127 | 40≤ SS-SINR | dB |

## 10.1.17 Power Headroom

### 10.1.17.1 Power Headroom Report

#### 10.1.17.1.1 Power Headroom Report Mapping

The power headroom reporting range is from -32 ...+38 dB. Table 10.1.17.1-1 defines the report mapping.

**Table 10.1.17.1-1: Power headroom report mapping**

| Reported value | Measured quantity value (dB) |
|---|---|
| POWER_HEADROOM_0 | PH < -32 |
| POWER_HEADROOM_1 | -32 ≤ PH < -31 |
| POWER_HEADROOM_2 | -31 ≤ PH < -30 |
| POWER_HEADROOM_3 | -30 ≤ PH < -29 |
| … | … |
| POWER_HEADROOM_53 | 20 ≤ PH < 21 |
| POWER_HEADROOM_54 | 21 ≤ PH < 22 |
| POWER_HEADROOM_55 | 22 ≤ PH < 24 |
| POWER_HEADROOM_56 | 24 ≤ PH < 26 |
| POWER_HEADROOM_57 | 26 ≤ PH < 28 |
| POWER_HEADROOM_58 | 28 ≤ PH < 30 |
| POWER_HEADROOM_59 | 30 ≤ PH < 32 |
| POWER_HEADROOM_60 | 32 ≤ PH < 34 |
| POWER_HEADROOM_61 | 34 ≤ PH < 36 |
| POWER_HEADROOM_62 | 36 ≤ PH < 38 |
| POWER_HEADROOM_63 | PH ≥ 38 |

## 10.1.18 $P_{CMAX,c,f}$

The UE is required to report the UE configured maximum output power ($P_{CMAX,c,f}$) together with the power headroom. This clause defines the requirements for the $P_{CMAX,c,f}$ reporting.

### 10.1.18.1 Report Mapping

The $P_{CMAX,c,f}$ reporting range is defined from -29dBm to 33 dBm with 1 dB resolution. Table 10.1.18.1-1 defines the reporting mapping.

**Table 10.1.18.1-1 Mapping of $P_{CMAX,c.f}$**

| Reported value | Measured quantity value | Unit |
|---|---|---|
| PCMAX_C_00 | $P_{CMAX,c,f}$ < -29 | dBm |
| PCMAX_C_01 | -29 ≤ $P_{CMAX,c,f}$ < -28 | dBm |
| PCMAX_C_02 | -28 ≤ $P_{CMAX,c,f}$ < -27 | dBm |
| … | … | … |
| PCMAX_C_61 | 31 ≤ $P_{CMAX,c,f}$ < 32 | dBm |
| PCMAX_C_62 | 32 ≤ $P_{CMAX,c,f}$ < 33 | dBm |
| PCMAX_C_63 | 33 ≤ $P_{CMAX,c,f}$ | dBm |

## 10.1.19 L1-RSRP accuracy requirements for FR1

### 10.1.19.1 SSB based L1-RSRP accuracy requirements

#### 10.1.19.1.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SSB based L1-RSRP in this clause apply to all SSBs of the serving cell configured for L1-RSRP measurement.

The accuracy requirements in Table 10.1.19.1.1-1 are valid under the following conditions:

- Conditions for L1-RSRP measurements are fulfilled according to Annex B.xx for a corresponding Band for each relevant SSB,
- Other conditions are TBD.

**Table 10.1.19.1.1-1: SSB based L1-RSRP absolute accuracy in FR1**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| | | | Io Note 1 range | | | | |
| Normal condition | Extreme condition | SSB Ês/Iot | NR operating band groups Note 2 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{SSB}$ | | $dBm/BW_{Channel}$ | $dBm/BW_{Channel}$ |
| | | | | $SCS_{SSB}$ = 15 kHz | $SCS_{SSB}$ = 30 kHz | | |
| TBD | TBD | ≥-3dB | NR_FDD_FR1_A, NR_TDD_FR1_A | -121 | -118 | N/A | -70 |
| | | | NR_FDD_FR1_B | -120.5 | -117.5 | N/A | -70 |
| | | | NR_TDD_FR1_C | -120 | -117 | N/A | -70 |
| | | | NR_FDD_FR1_D, NR_TDD_FR1_D | -119.5 | -116.5 | N/A | -70 |
| | | | NR_FDD_FR1_E, NR_TDD_FR1_E | -119 | -116 | N/A | -70 |
| | | | NR_FDD_FR1_G | -118 | -115 | N/A | -70 |
| | | | NR_FDD_FR1_H | -117.5 | -114.5 | N/A | -70 |
| TBD | TBD | TBD | NR_FDD_FR1_A, NR_TDD_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_G, NR_FDD_FR1_H, | N/A | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.<br>NOTE 2: NR operating band groups in FR1 are as defined in Section 3.5.2. | | | | | | | |

### 10.1.19.1.2 Relative Accuracy

The relative accuracy of SSB based L1-RSRP is defined as the L1-RSRP measured from one SSB compared to the largest measured value of L1-RSRP among all SSBs of the serving cell.

The accuracy requirements in Table 10.1.19.1.2-1 are valid under the following conditions:

- Conditions for L1-RSRP measurements are fulfilled according to Annex B.xx for a corresponding Band for each relevant SSB,

- Other conditions are TBD.

**Table 10.1.19.1.2-1: SSB based L1-RSRP relative accuracy in FR1**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot Note 2 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 4 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{SSB}$ | | dBm/$BW_{Channel}$ | dBm/$BW_{Channel}$ |
| | | | | $SCS_{SSB}$ = 15 kHz | $SCS_{SSB}$ = 30 kHz | | |
| TBD | TBD | ≥-3dB | NR_FDD_FR1_A, NR_TDD_FR1_A | -121 | -118 | N/A | -50 |
| | | | NR_FDD_FR1_B | -120.5 | -117.5 | N/A | -50 |
| | | | NR_TDD_FR1_C | -120 | -117 | N/A | -50 |
| | | | NR_FDD_FR1_D, NR_TDD_FR1_D | -119.5 | -116.5 | N/A | -50 |
| | | | NR_FDD_FR1_E, NR_TDD_FR1_E | -119 | -116 | N/A | -50 |
| | | | NR_FDD_FR1_G | -118 | -115 | N/A | -50 |
| | | | NR_FDD_FR1_H | -117.5 | -114.5 | N/A | -50 |
| TBD | TBD | TBD | Note 3 | Note 3 | Note 3 | N/A | Note 3 |

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of SSBs to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: NR operating band groups in FR1 are as defined in Section 3.5.2.

## 10.1.19.2 CSI-RS based L1-RSRP accuracy requirements

### 10.1.19.2.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute accuracy of CSI-RS based L1-RSRP in this clause apply to all CSI-RS resources of the serving cell configured for L1-RSRP measurement.

The accuracy requirements in Table 10.1.19.2.1-1 are valid under the following conditions:

- Conditions for L1-RSRP measurements are fulfilled according to Annex B.xx for a corresponding Band for each relevant CSI-RS,

- Other conditions are TBD.

**Table 10.1.19.2.1-1: CSI-RS based L1-RSRP absolute accuracy in FR1**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | CSI-RS Ês/Iot | Io Note 1 range | | | | |
| | | | NR operating band groups Note 2 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{CSI-RS}$ | | dBm/$BW_{Channel}$ | dBm/$BW_{Channel}$ |
| | | | | $SCS_{CSI-RS}$ = 15 kHz | $SCS_{CSI-RS}$ = 30 kHz | | |
| TBD | TBD | ≥-3dB | NR_FDD_FR1_A, NR_TDD_FR1_A | -121 | -118 | N/A | -70 |
| | | | NR_FDD_FR1_B | -120.5 | -117.5 | N/A | -70 |
| | | | NR_TDD_FR1_C | -120 | -117 | N/A | -70 |
| | | | NR_FDD_FR1_D, NR_TDD_FR1_D | -119.5 | -116.5 | N/A | -70 |
| | | | NR_FDD_FR1_E, NR_TDD_FR1_E | -119 | -116 | N/A | -70 |
| | | | NR_FDD_FR1_G | -118 | -115 | N/A | -70 |
| | | | NR_FDD_FR1_H | -117.5 | -114.5 | N/A | -70 |
| TBD | TBD | TBD | NR_FDD_FR1_A, NR_TDD_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_G, NR_FDD_FR1_H, | N/A | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.<br>NOTE 2: NR operating band groups in FR1 are as defined in Section 3.5.2. | | | | | | | |

### 10.1.19.2.2 Relative Accuracy

The relative accuracy of CSI-RS based L1-RSRP is defined as the L1-RSRP measured from one CSI-RS compared to the largest measured value of L1-RSRP among all CSI-RS resources of the serving cell.

The accuracy requirements in Table 10.1.19.2.2-1 are valid under the following conditions:

- Conditions for L1-RSRP measurements are fulfilled according to Annex B.xx for a corresponding Band for each relevant CSI-RS,

- Other conditions are TBD.

**Table 10.1.19.2.2-1: CSI-RS based L1-RSRP relative accuracy in FR1**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | CSI-RS Ês/Iot Note 2 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 4 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{CSI-RS}$ | | $dBm/BW_{Channel}$ | $dBm/BW_{Channel}$ |
| | | | | $SCS_{CSI-RS}$ = 15 kHz | $SCS_{CSI-RS}$ = 30 kHz | | |
| TBD | TBD | ≥-3dB | NR_FDD_FR1_A, NR_TDD_FR1_A | -121 | -118 | N/A | -50 |
| | | | NR_FDD_FR1_B | -120.5 | -117.5 | N/A | -50 |
| | | | NR_TDD_FR1_C | -120 | -117 | N/A | -50 |
| | | | NR_FDD_FR1_D, NR_TDD_FR1_D | -119.5 | -116.5 | N/A | -50 |
| | | | NR_FDD_FR1_E, NR_TDD_FR1_E | -119 | -116 | N/A | -50 |
| | | | NR_FDD_FR1_G | -118 | -115 | N/A | -50 |
| | | | NR_FDD_FR1_H | -117.5 | -114.5 | N/A | -50 |
| TBD | TBD | TBD | Note 3 | Note 3 | Note 3 | N/A | Note 3 |

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS Ês/Iot is the minimum SSB Ês/Iot of the pair of CSI-RS resources to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: NR operating band groups in FR1 are as defined in Section 3.5.2.

## 10.1.20 L1-RSRP accuracy requirements for FR2

### 10.1.20.1 SSB based L1-RSRP accuracy requirements

#### 10.1.20.1.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SSB based L1-RSRP in this clause apply to all SSBs of the serving cell configured for L1-RSRP measurement.

The accuracy requirements in Table 10.1.20.1.1-1 are valid under the following conditions:

- Conditions for L1-RSRP measurements are fulfilled according to Annex B.xx for a corresponding Band for each relevant SSB,
- Other conditions are TBD.

**Table 10.1.20.1.1-1: SSB based L1-RSRP absolute accuracy in FR2**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot | Io Note 1 range | | | | |
| | | | NR operating band groups Note 2 | Minimum Io | | | Maximum Io |
| | | | | dBm / SCS$_{SSB}$ | | dBm/BW$_{Channel}$ | dBm/BW$_{Channel}$ |
| dB | dB | dB | | SCS$_{SSB}$ = 120kHz | SCS$_{SSB}$ = 240kHz | | |
| TBD | TBD | ≥-3dB | NR_TDD_FR2_A | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_B | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_F | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_G | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_T | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_Y | TBD | TBD | N/A | -70 |
| TBD | TBD | TBD | NR_TDD_FR2_A, NR_TDD_FR2_B, NR_TDD_FR2_F, NR_TDD_FR2_G, NR_TDD_FR2_T, NR_TDD_FR2_Y | N/A | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.<br>NOTE 2: NR operating band groups in FR2 are as defined in Section 3.5.3. | | | | | | | |

### 10.1.20.1.2 Relative Accuracy

The relative accuracy of SSB based L1-RSRP is defined as the L1-RSRP measured from one SSB compared to the largest measured value of L1-RSRP among all SSBs of the serving cell.

The accuracy requirements in Table 10.1.20.1.2-1 are valid under the following conditions:

- Conditions for L1-RSRP measurements are fulfilled according to Annex B.xx for a corresponding Band for each relevant SSB,
- Other conditions are TBD.

**Table 10.1.20.1.2-1: SSB based L1-RSRP relative accuracy in FR2**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | SSB Ês/Iot Note 2 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 3 | Minimum Io | | | Maximum Io |
| | | | | dBm / SCS$_{SSB}$ | | dBm/BW$_{Channel}$ | dBm/BW$_{Channel}$ |
| dB | dB | dB | | SCS$_{SSB}$ = 120kHz | SCS$_{SSB}$ = 240kHz | | |
| TBD | TBD | ≥-3dB | NR_TDD_FR2_A | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_B | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_F | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_G | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_T | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_Y | TBD | TBD | N/A | TBD |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.<br>NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of SSBs to which the requirement applies.<br>NOTE 3: NR operating band groups in FR2 are as defined in Section 3.5.3. | | | | | | | |

## 10.1.20.2 CSI-RS based L1-RSRP accuracy requirements

### 10.1.20.2.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute accuracy of CSI-RS based L1-RSRP in this clause apply to all CSI-RS resources of the serving cell configured for L1-RSRP measurement.

The accuracy requirements in Table 10.1.20.2.1-1 are valid under the following conditions:

- Conditions for L1-RSRP measurements are fulfilled according to Annex B.xx for a corresponding Band for each relevant CSI-RS,
- Other conditions are TBD.

**Table 10.1.20.2.1-1: CSI-RS based L1-RSRP absolute accuracy in FR2**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | CSI-RS Ês/Iot | Io Note 1 range | | | | |
| | | | NR operating band groups Note 2 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{CSI-RS}$ | | dBm/$BW_{Channel}$ | dBm/$BW_{Channel}$ |
| | | | | $SCS_{CSI-RS}$ = 60kHz | $SCS_{CSI-RS}$ = 120kHz | | |
| TBD | TBD | ≥-3dB | NR_TDD_FR2_A | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_B | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_F | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_G | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_T | TBD | TBD | N/A | -70 |
| | | | NR_TDD_FR2_Y | TBD | TBD | N/A | -70 |
| TBD | TBD | TBD | NR_TDD_FR2_A, NR_TDD_FR2_B, NR_TDD_FR2_F, NR_TDD_FR2_G, NR_TDD_FR2_T, NR_TDD_FR2_Y | N/A | N/A | -70 | -50 |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.<br>NOTE 2: NR operating band groups in FR2 are as defined in Section 3.5.3. | | | | | | | |

### 10.1.20.2.2 Relative Accuracy

The relative accuracy of CSI-RS based L1-RSRP is defined as the L1-RSRP measured from one CSI-RS compared to the largest measured value of L1-RSRP among all CSI-RS resources of the serving cell.

The accuracy requirements in Table 10.1.20.2.2-1 are valid under the following conditions:

- Conditions for L1-RSRP measurements are fulfilled according to Annex B.xx for a corresponding Band for each relevant CSI-RS,
- Other conditions are TBD.

**Table 10.1.20.2.2-1: CSI-RS based L1-RSRP relative accuracy in FR2**

| Accuracy | | Conditions | | | | | |
|---|---|---|---|---|---|---|---|
| Normal condition | Extreme condition | CSI-RS Ês/Iot Note 2 | Io Note 1 range | | | | |
| | | | NR operating band groups Note 3 | Minimum Io | | | Maximum Io |
| dB | dB | dB | | dBm / $SCS_{CSI-RS}$ | | dBm/$BW_{Channel}$ | dBm/$BW_{Channel}$ |
| | | | | $SCS_{CSI-RS}$ = 60kHz | $SCS_{CSI-RS}$ = 120kHz | | |
| TBD | TBD | ≥-3dB | NR_TDD_FR2_A | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_B | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_F | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_G | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_T | TBD | TBD | N/A | TBD |
| | | | NR_TDD_FR2_Y | TBD | TBD | N/A | TBD |
| NOTE 1: Io is assumed to have constant EPRE across the bandwidth.<br>NOTE 2: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of CSI-RS resources to which the requirement applies.<br>NOTE 3: NR operating band groups in FR2 are as defined in Section 3.5.3. | | | | | | | |

# 10.2 E-UTRAN measurements

## 10.2.1 Introduction

Accuracy requirements for E-UTRAN measurements are specified in Section 10.2.

The requirements in this clause are applicable for a UE:

- in RRC_CONNECTED state
- performing measurements with appropriate measurement gaps according to section 9.1.2.
- that is synchronised to the cell that is measured.

The reported measurement result after layer 1 filtering shall be an estimate of the average value of the measured quantity over the measurement period. The reference point for the measurement result after layer 1 filtering is referred to as point B in the measurement model described in TS 36.300 [24].

The accuracy requirements of E-UTRA measurements in this clause are valid for the reported measurement result after layer 1 filtering. The accuracy requirements are verified from the measurement report at point D in the measurement model having the layer 3 filtering disabled.

If the UE needs measurement gaps to perform the inter-RAT NR ─ E-UTRAN FDD and NR ─ E-UTRAN TDD measurements, the relevant measurement procedure and measurement gap patterns stated in Section 9.1.2 shall apply.

## 10.2.2 E-UTRAN RSRP measurements

NOTE: This measurement is for handover between NR and E-UTRAN.

The measurement period of E-UTRA RSRP in RRC_CONNECTED state is specified in section 9.4.2 and 9.4.3.

The accuracy requirements of E-UTRA RSRP measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRP Accuracy Requirements in TS 36.133 [15, Section 9.1.3].

The reporting range and mapping specified for RSRP measurements in TS 36.133 [15, Section 9.1.4] shall apply.

## 10.2.3 E-UTRAN RSRQ measurements

NOTE: This measurement is for handover between NR and E-UTRAN.

The measurement period of E-UTRA RSRQ in RRC_CONNECTED state is specified in section 9.4.2 and 9.4.3.

The accuracy requirements of E-UTRA RSRQ measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRQ Accuracy Requirements in TS 36.133 [15, Section 9.1.6].

The requirements for accuracy of E-UTRA RSRQ measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRQ Accuracy Requirements in TS 36.133 [15, Section 9.1.6].

The reporting range and mapping specified for RSRQ measurements in TS 36.133 [15, Section 9.1.7] shall apply.

## 10.2.4 E-UTRAN RSTD measurements

The requirements in this section are valid for UE supporting this capability.

The measurement period is specified in Sections 9.4.4.1 and 9.4.4.2 for inter-RAT NR ─ E-UTRAN FDD and inter-RAT NR ─ E-UTRAN TDD RSTD measurements, respectively.

The accuracy requirements and the corresponding side conditions shall be the same as the inter-frequency measurement accuracy requirements for RSTD measurements in RRC_CONNECTED in TS 36.133 [15, Section 9.1.10.2].

If the UE needs measurement gaps to perform the inter-RAT NR ─ E-UTRAN FDD and NR ─ E-UTRAN TDD RSTD measurements, the relevant measurement procedure and measurement gap patterns stated in Section 9.1.2 shall apply.

The reporting range and mapping for the inter-RAT NR ─ E-UTRAN FDD and NR ─ E-UTRAN TDD RSTD measurements is the same as specified for RSTD measurements in TS 36.133 [15, Sections 9.1.10.3 and 9.1.10.4].

### 10.2.5 E-UTRAN RS-SINR measurements

NOTE: This measurement is for handover between NR and E-UTRAN.

The measurement period of E-UTRA RS-SINR in RRC_CONNECTED state is specified in section 9.4.2 and 9.4.3.

The accuracy requirements of E-UTRA RS-SINR measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RS-SINR Accuracy Requirements in TS 36.133 [15, Section 9.1.17.3].

The reporting range and mapping for E-UTRA RS-SINR measurements shall be the same as specified for RS-SINR measurements in TS 36.133 [15, 9.1.17.1].

# 11 Measurements Performance Requirements for NR network

Editor's note: network side measurement and mapping tables may be specified in this section. If RAN4 decides to move NR network requirements to gNodeB specification, this section might be removed.

# Annex A (normative): Test Cases

# A.1 Purpose of annex

# A.2 Requirement classification for statistical testing

Requirements in this specification are either expressed as absolute requirements with a single value stating the requirement, or expressed as a success rate. There are no provisions for the statistical variations that will occur when the parameter is tested.

Annex A outlines the tests in more detail and lists the test parameters needed. The test will result in an outcome of a test variable value for the device under test (DUT) inside or outside the test limit. Overall, the probability of a "good" DUT being inside the test limit(s) and the probability of a "bad" DUT being outside the test limit(s) should be as high as possible. For this reason, when selecting the test variable and the test limit(s), the statistical nature of the test is accounted for.

The statistical nature depends on the type of requirement. Some have large statistical variations, while others are not statistical in nature at all. When testing a parameter with a statistical nature, a confidence level is set. This establishes the probability that a DUT passing the test actually meets the requirements and determines how many times a test has to be repeated and what the pass and fail criteria are. Those aspects are not covered by TS 38.133. The details of the tests on how many times to run it and how to establish confidence in the tests are described in TS 38.533 [5]. This Annex establishes the variable to be used in the test and whether it can be viewed as statistical in nature or not.

## A.2.1 Types of requirements in TS 38.133

### A.2.1.1 Time and delay requirements on UE higher layer actions

A very large part of the RRM requirements are delay requirements:

- In RRC_IDLE state mobility (clause A.4.x, A.5.x, A.6.x and A.7.x) there is cell re-selection delay.
- In RRC_CONNECTED state mobility (clauses A.4.3, A.4.6, A.5.3, A.5.6, A.6.3, A.6.6, A.7.3 and A.7.6) there is handover delay, cell search delay and measurement reporting delay.
- In RRC Connection Control (clauses A.4.3.2, A.5.3.2, A.6.3.2 and A.7.3.2) there is RRC re-establishment delay.

All have in common that the UE is required to perform an action observable in higher layers (e.g. camp on the correct cell) within a certain time after a specific event (e.g. when a new strong pilot or reference signal appears). The delay time is statistical in nature for several reasons, among others that several of the measurements are performed by the UE in a fading radio environment.

The variations make a strict limit unsuitable for a test. Instead there is a condition set for a correct action by the UE, e.g. that the UE shall camp on the correct cell within X seconds. Then the rate of correct events is observed during repeated tests and a limit is set on the rate of correct events, usually 90% correct events are required. How the limit is applied in the test depends on the confidence required, further detailed are in TS 38.533 [5].

### A.2.1.2 Measurements of power levels, relative powers and time

A very large number of requirements are on measurements that the UE performs:

- In RRC_CONNECTED state mobility (clauses A.4.3, A.5.3, A.6.3 and A.7.3) there are measurement reports.
- In Measurement Performance Requirements (clauses A.4.7, A.5.7, A.6.7 and A.7.7) there are requirements for all type of measurements.

The accuracy requirements on measurements are expressed in this specification as a fixed limit (e.g. +/-X dB), but the measurement error will have a distribution that is not easily confined in fixed limits. Assuming a Gaussian distribution of the error, the limits will have to be set at +/-3.29σ if the probability of failing a "good DUT" in a single test is to be kept at 0.1%. It is more reasonable to set the limit tighter and test the DUT by counting the rate of measurements that are within the limits, in a way similar to the requirements on delay.

### A.2.1.3 Implementation requirements

A few requirements are strict actions the UE should take or capabilities the UE should have, without any allowance for deviations. These requirements are absolute and should be tested as such. Examples are:

- "Event triggered report rate" in RRC_CONNECTED state mobility (clauses A.4.3, A.4.6, A.5.3, A.5.6, A.6.3, A.6.6, A.7.3 and A.7.6)

- "Correct behaviour at time-out" in RRC connection control (clauses A.4.3.2, A.5.3.2, A.6.3.2 and A.7.3.2)

### A.2.1.4 Physical layer timing requirements

There are requirements on Timing (clauses A.4.4, A.5.4, A.6.4 and A.7.4). There are both absolute and relative limits on timing accuracy depending upon the type of requirement. Examples are:

- Initial Transmit Timing (clauses A.4.4.1, A.5.4.1, A.6.4.1 and A.7.4.1) has an absolute limit on timing accuracy.

- Timing Advance (clauses A.4.4.2, A.5.4.2, A.6.4.2 and A.7.4.2) has a relative limit on timing accuracy.

# A.3 RRM test configurations

## A.3.1 Reference measurement channels

### A.3.1.1 PDSCH

#### A.3.1.1.1 FDD

**Table A.3.1.1.1-1: PDSCH Reference Measurement Channels for SCS=15kHz**

| Parameter | Unit | Value | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Reference channel | | SR.1.1 FDD | | | | | | |
| Channel bandwidth | MHz | 10 | | | | | | |
| Number of transmitter antennas | | 1 | | | | | | |
| Allocated resource blocks for PDSCH [Note 1] | | 24 | | | | | | |
| Allocated slots per Radio Frame | | 10 | | | | | | |
| Radio frame containing SSB | slots | Note 5 | | | | | | |
| Radio frame not containing SSB | slots | [10] | | | | | | |
| MCS index | | 4 | | | | | | |
| Modulation | | QPSK | | | | | | |
| Target Coding Rate | | 1/3 | | | | | | |
| Number of control symbols | | 2 | | | | | | |
| PDSCH mapping type | | Type A | | | | | | |
| Information Bit Payload | | | | | | | | |
| For slots with RMSI [Note 2] | Bits | [1864] | | | | | | |
| Number of Code Blocks per slot | | 1 | | | | | | |
| Binary Channel Bits Per slot | | | | | | | | |
| For slots with RMSI [Note 2, Note 4] | Bits | [6048] | | | | | | |

Note 1: Allocated outside the SMTC duration in time and in resource blocks which do not overlap with the resource blocks allocated for SS/PBCH block.
Note 2: PDSCH is scheduled on the slots with RMSI.
Note 3: If necessary the information bit payload size can be adjusted to facilitate the test implementation. The payload sizes are defined in TS 38.213 [3].
Note 4: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 1.
Note 5: PDSCH is not scheduled in slots containing SSB according to the SSB configuration used in the test. SSB configurations are defined in section A.3.10.

### A.3.1.1.2 TDD

**Table A.3.1.1.2-1: PDSCH Reference Measurement Channels for SCS=15kHz**

| Parameter | Unit | Value | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Reference channel | | SR.1.1 TDD | | | | | | |
| Channel bandwidth | MHz | 10 | | | | | | |
| Number of transmitter antennas | | 1 | | | | | | |
| Allocated resource blocks for PDSCH Note 1 | | 24 | | | | | | |
| Allocated slots per Radio Frame | | | | | | | | |
| Radio frame containing SSB | slots | Note 5 | | | | | | |
| Radio frame not containing SSB | slots | [4] | | | | | | |
| MCS table | | 64QAM | | | | | | |
| MCS index | | 4 | | | | | | |
| Modulation | | QPSK | | | | | | |
| Target Coding Rate | | 1/3 | | | | | | |
| Number of control symbols | | 2 | | | | | | |
| PDSCH mapping type | | Type A | | | | | | |
| Information Bit Payload | | | | | | | | |
| For slots with RMSI Note 2 | Bits | [1864] | | | | | | |
| Number of Code Blocks per slot | | 1 | | | | | | |
| Binary Channel Bits Per slot | | | | | | | | |
| For slots with RMSI Note 2, Note 4 | Bits | [6048] | | | | | | |

Note 1: Allocated outside the SMTC duration in time and in resource blocks which do not overlap with the resource blocks allocated for SS/PBCH block.
Note 2: PDSCH is scheduled on the slots with RMSI.
Note 3: If necessary the information bit payload size can be adjusted to facilitate the test implementation. The payload sizes are defined in TS 38.213 [3].
Note 4: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 1.
Note 5: PDSCH is not scheduled in slots containing SSB according to the SSB configuration used in the test. SSB configurations are defined in section A.3.10.

**Table A.3.1.1.1-2: PDSCH Reference Measurement Channels for SCS=30kHz**

| Parameter | Unit | Value | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Reference channel | | SR.2.1 TDD | | | | | | |
| Channel bandwidth | MHz | 40 | | | | | | |
| Number of transmitter antennas | | 1 | | | | | | |
| Allocated resource blocks for PDSCH Note 1 | | 24 | | | | | | |
| Allocated slots per Radio Frame | | | | | | | | |
| Radio frame containing SSB | slots | Note 5 | | | | | | |
| Radio frame not containing SSB | slots | [10] | | | | | | |
| MCS table | | 64QAM | | | | | | |
| MCS index | | 4 | | | | | | |
| Modulation | | QPSK | | | | | | |
| Target Coding Rate | | 1/3 | | | | | | |
| Number of control symbols | | 2 | | | | | | |
| PDSCH mapping type | | Type A | | | | | | |
| Information Bit Payload | | | | | | | | |
| For slots with RMSI Note 2 | Bits | [1864] | | | | | | |
| Number of Code Blocks per slot | | 1 | | | | | | |
| Binary Channel Bits Per slot | | | | | | | | |
| For slots with RMSI Note 2, Note 4 | Bits | [6048] | | | | | | |

Note 1: Allocated outside the SMTC duration in time and in resource blocks which do not overlap with the resource blocks allocated for SS/PBCH block.
Note 2: PDSCH is scheduled on the slots with RMSI.
Note 3: If necessary the information bit payload size can be adjusted to facilitate the test implementation. The payload sizes are defined in TS 38.213 [3].
Note 4: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 1.
Note 5: PDSCH is not scheduled in slots containing SSB according to the SSB configuration used in the test. SSB configurations are defined in section A.3.10.

**Table A.3.1.1.1-3: PDSCH Reference Measurement Channels for SCS=120kHz**

| Parameter | Unit | Value | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Reference channel | | SR.3.1 TDD | | | | | | |
| Channel bandwidth | MHz | 100 | | | | | | |
| Number of transmitter antennas | | 1 | | | | | | |
| Allocated resource blocks for PDSCH Note 1 | | 24 | | | | | | |
| Allocated slots per Radio Frame | | | | | | | | |
| Radio frame containing SSB | slots | Note 5 | | | | | | |
| Radio frame not containing SSB | slots | [48] | | | | | | |
| MCS table | | 64QAM | | | | | | |
| MCS index | | 4 | | | | | | |
| Modulation | | QPSK | | | | | | |
| Target Coding Rate | | 1/3 | | | | | | |
| Number of control symbols | | 2 | | | | | | |
| PDSCH mapping type | | Type A | | | | | | |
| Information Bit Payload | | | | | | | | |
| For slots with RMSI Note 2 | Bits | [1864] | | | | | | |
| Number of Code Blocks per slot | | 1 | | | | | | |
| Binary Channel Bits Per slot | | | | | | | | |
| For slots with RMSI Note 2, Note 4 | Bits | [6048] | | | | | | |

Note 1: Allocated outside the SMTC duration in time and in resource blocks which do not overlap with the resource blocks allocated for SS/PBCH block
Note 2: PDSCH is scheduled on the slots with RMSI.
Note 3: If necessary the information bit payload size can be adjusted to facilitate the test implementation. The payload sizes are defined in TS 38.213 [3].
Note 4: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 1.
Note 5: PDSCH is not scheduled in slots containing SSB according to the SSB configuration used in the test. SSB configurations are defined in section A.3.10.

### A.3.1.2 CORESET for RMSI scheduling

#### A.3.1.2.1 FDD

**Table A.3.1.2.1-1: RMSI CORESET Reference Channel for FDD with SCS=15KHz**

| Parameter | Unit | Value | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Reference channel | | CR.1.1 FDD | | | | | | | |
| Channel bandwidth | MHz | 10 | | | | | | | |
| Subcarrier spacing for RMSI CORESET | KHz | 15 | | | | | | | |
| Allocated resource blocks for RMSI CORESET [Note 7] | | 24 | | | | | | | |
| Subcarrier spacing for SSB | KHz | 15 | | | | | | | |
| SSB and RMSI CORESET multiplexing configuration [Note 7] | | Pattern 1 | | | | | | | |
| Offset between SSB and RMSI CORESET [Note 3, 7] | RB | 0 | | | | | | | |
| Configuration of PDCCH monitoring occasions for RMSI CORESET [Note 4] | | Index 4 | | | | | | | |
| Number of transmitter antennas | | 1 | | | | | | | |
| Duration of RMSI CORESET [Note 7] | symbols | 2 | | | | | | | |
| DCI Format [Note 1] | | Note 2 | | | | | | | |
| Aggregation level | CCE | 8 | | | | | | | |
| DMRS precoder granularity | | 6 | | | | | | | |
| REG bundle size | | 6 | | | | | | | |
| Mapping from REG to CCE | | Distributed | | | | | | | |
| Cell ID | | Note 5 | | | | | | | |
| Payload (without CRC) | Bits | Note 6 | | | | | | | |

Note 1: DCI formats are defined in TS 38.212.
Note 2: DCI format shall depend upon the test configuration.
Note 3: The offset is defined with respect to the subcarrier spacing of the CORESET from the smallest RB index of RMSI CORESET to the smallest RB index of the common RB overlapping with the first RB of the SS/PBCH block.
Note 4: The configuration of PDCCH monitoring occasions for RMSI CORESET is defined in Table 13-11 in TS 38.213 [3].
Note 5: Cell ID shall depend upon the test configuration.
Note 6: Payload size shall depend upon the test configuration.
Note 7: The configuration of set of resource blocks and slot symbols of control resource set for Type0-PDCCH search space corresponds to index 0 in Table 13-1 in TS 38.213

### A.3.1.2.2 TDD

**Table A.3.1.2.2-1: RMSI CORESET Reference Channel for TDD with SCS=15KHz**

| Parameter | Unit | Value | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Reference channel | | CR.1.1 TDD | | | | | | |
| Channel bandwidth | MHz | 10 | | | | | | |
| Subcarrier spacing | KHz | 15 | | | | | | |
| Allocated resource blocks for RMSI CORESET Note 7 | | 24 | | | | | | |
| Index of transmited SSB within an SS-Burst | | #0 | | | | | | |
| SSB and RMSI CORESET multiplexing configuration Note 7 | | Pattern 1 | | | | | | |
| Offset between SSB and RMSI CORESET Note 3, 7 | RB | 0 | | | | | | |
| Configuration of PDCCH monitoring occasions for RMSI CORESET Note 4 | | Index 4 | | | | | | |
| Number of transmitter antennas | | 1 | | | | | | |
| Duration of RMSI CORESET Note 7 | symbols | 2 | | | | | | |
| DCI Format Note 1 | | Note 2 | | | | | | |
| Aggregation level | CCE | 8 | | | | | | |
| DMRS precoder granularity | | 6 | | | | | | |
| REG bundle size | | 6 | | | | | | |
| Mapping from REG to CCE | | Distributed | | | | | | |
| Cell ID | | Note 5 | | | | | | |
| Payload (without CRC) | Bits | Note 6 | | | | | | |

Note 1: DCI formats are defined in TS 38.212.
Note 2: DCI format shall depend upon the test configuration.
Note 3: The offset is defined with respect to the subcarrier spacing of the CORESET from the smallest RB index of RMSI CORESET to the smallest RB index of the common RB overlapping with the first RB of the SS/PBCH block.
Note 4: The configuration of PDCCH monitoring occasions for RMSI CORESET is defined in Table 13-11 in TS 38.213 [3].
Note 5: Cell ID shall depend upon the test configuration.
Note 6: Payload size shall depend upon the test configuration.
Note 7: The configuration of set of resource blocks and slot symbols of control resource set for Type0-PDCCH search space corresponds to index 0 in Table 13-1 in TS 38.213

**Table A.3.1.2.2-2: RMSI CORESET Reference Channel for TDD with SCS=30KHz**

| Parameter | Unit | Value | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Reference channel | | CR.2.1 TDD | | | | | | |
| Channel bandwidth | MHz | 40 | | | | | | |
| Subcarrier spacing | KHz | 30 | | | | | | |
| Allocated resource blocks for RMSI CORESET Note 7 | | 24 | | | | | | |
| Index of transmited SSB within an SS-Burst | | #0 | | | | | | |
| SSB and RMSI CORESET multiplexing configuration Note 7 | | Pattern 1 | | | | | | |
| Offset between SSB and RMSI CORESET Note 3, 7 | RB | 0 | | | | | | |
| Configuration of PDCCH monitoring occasions for RMSI CORESET Note 4 | | Index 4 | | | | | | |
| Number of transmitter antennas | | 1 | | | | | | |
| Duration of RMSI CORESET Note 7 | symbols | 2 | | | | | | |
| DCI Format Note 1 | | Note 2 | | | | | | |
| Aggregation level | CCE | 8 | | | | | | |
| DMRS precoder granularity | | 6 | | | | | | |
| REG bundle size | | 6 | | | | | | |
| Mapping from REG to CCE | | Distributed | | | | | | |
| Cell ID | | Note 5 | | | | | | |
| Payload (without CRC) | Bits | Note 6 | | | | | | |
| Note 1: DCI formats are defined in TS 38.212.<br>Note 2: DCI format shall depend upon the test configuration.<br>Note 3: The offset is defined with respect to the subcarrier spacing of the CORESET from the smallest RB index of RMSI CORESET to the smallest RB index of the common RB overlapping with the first RB of the SS/PBCH block.<br>Note 4: The configuration of PDCCH monitoring occasions for RMSI CORESET is defined in Table 13-11 in TS 38.213 [3].<br>Note 5: Cell ID shall depend upon the test configuration.<br>Note 6: Payload size shall depend upon the test configuration.<br>Note 7: The configuration of set of resource blocks and slot symbols of control resource set for Type0-PDCCH search space corresponds to index 0 in Table 13-6 in TS 38.213 | | | | | | | | |

**Table A.3.1.2.2-3: RMSI CORESET Reference Channel for TDD with SCS=120KHz**

| Parameter | Unit | Value | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Reference channel | | CR.3.1 TDD | | | | | | |
| Channel bandwidth | MHz | 100 | | | | | | |
| Subcarrier spacing | KHz | 120 | | | | | | |
| Allocated resource blocks for RMSI CORESET Note 7 | | 24 | | | | | | |
| Subcarrier spacing for SSB | KHz | 120 | | | | | | |
| SSB and RMSI CORESET multiplexing configuration Note 7 | | Pattern 1 | | | | | | |
| Offset between SSB and RMSI CORESET Note 3, 7 | RB | 0 | | | | | | |
| Configuration of PDCCH monitoring occasions for RMSI CORESET Note 4 | | Index 4 | | | | | | |
| Number of transmitter antennas | | 1 | | | | | | |
| Duration of RMSI CORESET Note 7 | symbols | 2 | | | | | | |
| DCI Format Note 1 | | Note 2 | | | | | | |
| Aggregation level | CCE | 8 | | | | | | |
| DMRS precoder granularity | | 6 | | | | | | |
| REG bundle size | | 6 | | | | | | |
| Mapping from REG to CCE | | Distributed | | | | | | |
| Cell ID | | Note 5 | | | | | | |
| Payload (without CRC) | Bits | Note 6 | | | | | | |

Note 1: DCI formats are defined in TS 38.212.
Note 2: DCI format shall depend upon the test configuration.
Note 3: The offset is defined with respect to the subcarrier spacing of the CORESET from the smallest RB index of RMSI CORESET to the smallest RB index of the common RB overlapping with the first RB of the SS/PBCH block.
Note 4: The configuration of PDCCH monitoring occasions for RMSI CORESET is defined in Table 13-12 in TS 38.213 [3].
Note 5: Cell ID shall depend upon the test configuration.
Note 6: Payload size shall depend upon the test configuration.
Note 7: The configuration of set of resource blocks and slot symbols of control resource set for Type0-PDCCH search space corresponds to index 0 in Table 13-8 in TS 38.213

### A.3.1.3 CORESET for RMC scheduling

#### A.3.1.3.1 FDD

**Table A.3.1.3.1-1: Control Channel RMC for FDD with SCS=15KHz**

| Parameter | Unit | Value | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Reference channel | | [CCR.1.1] FDD | | | | | | |
| Channel bandwidth | MHz | 10 | | | | | | |
| Subcarrier spacing | KHz | 15 | | | | | | |
| Allocated resource blocks for CORESET Note 3 | | 24 | | | | | | |
| Number of transmitter antennas | | 1 | | | | | | |
| Duration of CORESET | symbols | 2 | | | | | | |
| REG bundle size | | 6 | | | | | | |
| DMRS precoder granularity | | Same as REG bundle size | | | | | | |
| CCE to REG mapping | | Interleaved | | | | | | |
| Interleave n_shift | | 0 | | | | | | |
| Interleave size | | 2 | | | | | | |
| Beamforming Pre-Coder | | N/A | | | | | | |
| Aggregation level | CCE | 8 | | | | | | |
| DCI formats | | Note 1 | | | | | | |
| Payload size (without CRC) | bits | Note 2 | | | | | | |
| Note 1: DCI format shall depend upon the test configuration.<br>Note 2: Payload size shall depend upon the test configuration<br>Note 3: Allocated in the same resource blocks where the associated RMC is scheduled. | | | | | | | | |

#### A.3.1.3.2 TDD

**Table A.3.1.3.2-1: Control Channel RMC for TDD with SCS=15KHz**

| Parameter | Unit | Value | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Reference channel | | [CCR.1.1] TDD | | | | | | |
| Channel bandwidth | MHz | 10 | | | | | | |
| Subcarrier spacing | KHz | 15 | | | | | | |
| Allocated resource blocks for CORESET Note 3 | | 24 | | | | | | |
| Number of transmitter antennas | | 1 | | | | | | |
| Duration of CORESET | symbols | 2 | | | | | | |
| REG bundle size | | 6 | | | | | | |
| DMRS precoder granularity | | Same as REG bundle size | | | | | | |
| CCE to REG mapping | | Interleaved | | | | | | |
| Interleave n_shift | | 0 | | | | | | |
| Interleave size | | 2 | | | | | | |
| Beamforming Pre-Coder | | N/A | | | | | | |
| Aggregation level | CCE | 8 | | | | | | |
| DCI formats | | Note 1 | | | | | | |
| Payload size (without CRC) | bits | Note 2 | | | | | | |
| Note 1: DCI format shall depend upon the test configuration.<br>Note 2: Payload size shall depend upon the test configuration<br>Note 3: Allocated in the same resource blocks where the associated RMC is scheduled. | | | | | | | | |

### Table A.3.1.3.2-2: Control Channel RMC for TDD with SCS=30KHz

| Parameter | Unit | Value | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Reference channel | | [CCR.2.1] TDD | | | | | | |
| Channel bandwidth | MHz | 40 | | | | | | |
| Subcarrier spacing | KHz | 30 | | | | | | |
| Allocated resource blocks for CORESET Note 3 | | 24 | | | | | | |
| Number of transmitter antennas | | 1 | | | | | | |
| Duration of CORESET | symbols | 2 | | | | | | |
| REG bundle size | | 6 | | | | | | |
| DMRS precoder granularity | | Same as REG bundle size | | | | | | |
| CCE to REG mapping | | Interleaved | | | | | | |
| Interleave n_shift | | 0 | | | | | | |
| Interleave size | | 2 | | | | | | |
| Beamforming Pre-Coder | | N/A | | | | | | |
| Aggregation level | CCE | 8 | | | | | | |
| DCI formats | | Note 1 | | | | | | |
| Payload size (without CRC) | bits | Note 2 | | | | | | |
| Note 1: DCI format shall depend upon the test configuration.<br>Note 2: Payload size shall depend upon the test configuration<br>Note 3: Allocated in the same resource blocks where the associated RMC is scheduled. | | | | | | | | |

### Table A.3.1.3.2-3: Control Channel RMC for TDD with SCS=120KHz

| Parameter | Unit | Value | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Reference channel | | [CCR.3.1] TDD | | | | | | |
| Channel bandwidth | MHz | 100 | | | | | | |
| Subcarrier spacing | KHz | 120 | | | | | | |
| Allocated resource blocks for CORESET Note 3 | | 24 | | | | | | |
| Number of transmitter antennas | | 1 | | | | | | |
| Duration of CORESET | symbols | 2 | | | | | | |
| REG bundle size | | 6 | | | | | | |
| DMRS precoder granularity | | Same as REG bundle size | | | | | | |
| CCE to REG mapping | | Interleaved | | | | | | |
| Interleave n_shift | | 0 | | | | | | |
| Interleave size | | 2 | | | | | | |
| Beamforming Pre-Coder | | N/A | | | | | | |
| Aggregation level | CCE | 8 | | | | | | |
| DCI formats | | Note 1 | | | | | | |
| Payload size (without CRC) | bits | Note 2 | | | | | | |
| Note 1: DCI format shall depend upon the test configuration.<br>Note 2: Payload size shall depend upon the test configuration<br>Note 3: Allocated in the same resource blocks where the associated RMC is scheduled. | | | | | | | | |

### A.3.1.4 TDD UL/DL configuration

**Table A.3.1.4-1: TDD UL/DL configuration for SCS=15kHz**

| Parameter | Unit | Value | | |
|---|---|---|---|---|
| Reference channel | | TDDConf.1.1 | | |
| *referenceSubcarrierSpacing* | kHz | 15 | | |
| TDD UL/DL pattern 1 Note 2 | | 'DSUU'<br>S='9DL:3GP:2UL' | | |
| *dl-UL-TransmissionPeriodicity* | ms | 4 | | |
| *nrofDownlinkSlots* | | 1 | | |
| *nrofDownlinkSymbols* | | 9 | | |
| *nrofUplinkSlot* | | 2 | | |
| *nrofUplinkSymbols* | | 2 | | |
| TDD UL/DL pattern 2 Note 2 | | 'D' | | |
| *dl-UL-TransmissionPeriodicity* | ms | 1 | | |
| *nrofDownlinkSlots* | | 1 | | |
| *nrofDownlinkSymbols* | | 0 | | |
| *nrofUplinkSlot* | | 0 | | |
| *nrofUplinkSymbols* | | 0 | | |
| Note 1: As specified in TS 38.213 [3] and TS 38.331 [2].<br>Note 2: For information | | | | |

**Table A.3.1.4-2: TDD UL/DL configuration for SCS=30kHz**

| Parameter | Unit | Value | | |
|---|---|---|---|---|
| Reference channel | | TDDConf.2.1 | | |
| *referenceSubcarrierSpacing* | kHz | 30 | | |
| TDD UL/DL pattern 1 Note 2 | | '3D1S4U'<br>S='4DL:6GP:4UL' | | |
| *dl-UL-TransmissionPeriodicity* | ms | 4 | | |
| *nrofDownlinkSlots* | | 3 | | |
| *nrofDownlinkSymbols* | | 4 | | |
| *nrofUplinkSlot* | | 4 | | |
| *nrofUplinkSymbols* | | 4 | | |
| TDD UL/DL pattern 2 Note 2 | | 'DD' | | |
| *dl-UL-TransmissionPeriodicity* | ms | 1 | | |
| *nrofDownlinkSlots* | | 2 | | |
| *nrofDownlinkSymbols* | | 0 | | |
| *nrofUplinkSlot* | | 0 | | |
| *nrofUplinkSymbols* | | 0 | | |
| Note 1: As specified in TS 38.213 [3] and TS 38.331 [2].<br>Note 2: For information | | | | |

## A.3.2 OFDMA channel noise generator (OCNG)

### A.3.2.1 Generic OFDMA Channel Noise Generator (OCNG)

The OCNG pattern is used in a test for modelling allocations of unused resources in the channel bandwidth to virtual UEs (which are not under test). The OCNG pattern comprises PDCCH and PDSCH transmissions to the virtual UEs.

#### A.3.2.1.1 OCNG pattern 1: Generic OCNG pattern for all unused REs

**Table A.3.2.1.1-1: OP.1: Generic OCNG pattern for all unused REs**

| OCNG Parameters | Control Region | Data Region |
|---|---|---|
| Resource allocation | Unused REs (Note 1) | Unused REs (Note 2) |
| Channel | PDCCH | PDSCH |
| Contents | Virtual UE IDs | Uncorrelated pseudo random QPSK modulated data |
| Antenna transmission scheme | Same as used in PDCCH RMC | Same as used in PDSCH RMC |
| Subcarrier spacing | Same as used in PDCCH RMC | Same as used in PDSCH RMC |
| Aggregation level | Same as used in PDCCH RMC | N/A |
| Code rate | Same as used in PDCCH RMC | Same as used in PDSCH RMC |
| Transmit Power | Same as used in PDCCH RMC | Same as used in PDSCH RMC |
| CP length | Same as used in PDCCH RMC | Same as used in PDSCH RMC |
| Note 1: REs not used in the active CORESETs where PDCCH is scheduled for the UE under test.<br>Note 2: REs not allocated to any physical channels, CORESET, SSB or any other reference signal within the channel bandwidth of the cell. | | |

### A.3.2.2 Void

## A.3.3 Reference DRX configurations

### A.3.3.1 DRX Configuration 1: DRX cycle = 40 ms and TAT = 500 ms

**Table A.3.3.1-1: DRX.1: DRX cycle = 40 ms and time alignment timer (TAT) = 500 ms**

| Field | Value |
|---|---|
| drx-onDurationTimer | 1 ms |
| drx-InactivityTimer | 1 ms |
| drx-RetransmissionTimerDL | 1 slot |
| drx-RetransmissionTimerUL | 1 slot |
| drx-LongCycleStartOffset | 40 ms |
| shortDRX | disable |
| TimeAlignmentTimer | 500 ms |
| Note: The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2] | |

### A.3.3.2 DRX Configuration 2: DRX cycle = 640 ms and TAT = 500 ms

**Table A.3.3.2-1: DRX.2: DRX cycle = 640 ms and time alignment timer (TAT) = 500 ms**

| Field | Value |
|---|---|
| drx-onDurationTimer | 1 ms |
| drx-InactivityTimer | 1 ms |
| drx-RetransmissionTimerDL | 1 slot |
| drx-RetransmissionTimerUL | 1 slot |
| drx-LongCycleStartOffset | 640 ms |
| shortDRX | disable |
| TimeAlignmentTimer | 500 ms |
| Note: The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2] | |

#### A.3.3.3 DRX Configuration 3: DRX cycle = 40 ms and TAT = Infinity

**Table A.3.3.3-1: DRX.3: DRX cycle = 40 ms and time alignment timer (TAT) = Infinity**

| Field | Value |
|---|---|
| drx-onDurationTimer | 6 ms |
| drx-InactivityTimer | 1 ms |
| drx-RetransmissionTimerDL | 1 slot |
| drx-RetransmissionTimerUL | 1 slot |
| drx-LongCycleStartOffset | 40 ms |
| shortDRX | disable |
| TimeAlignmentTimer | Infinity |
| Note: The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2] | |

### A.3.4 Duplex mode

### A.3.5 Test cases with different numerologies

### A.3.6 Antenna configurations

#### A.3.6.1 Antenna configurations for FR1

Unless otherwise specified, NR FDD or NR TDD cells in all RRM Test cases in AWGN propagation condition are configured with Antenna Configuration 1x2.

##### A.3.6.1.1 Antenna connection for 4 Rx capable UEs

###### A.3.6.1.1.1 Introduction

All tests in section A.4 and A.6 are specified for UEs supporting 2RX. In this section, the antenna connection method for applying 2RX tests to UEs supporting 4RX antenna ports is specified. No tests are currently specified in section A.4 or A.6 which are applicable only to 4RX antenna ports, so 4RX capable UEs are always tested by reusing tests which were originally specified for 2RX UEs.

###### A.3.6.1.1.2 Principle of testing

###### A.3.6.1.1.2.1 Single carrier tests

For 4RX capable UEs supporting at least one 2RX band, the, all single carrier tests specified in section A.4 and A.6 except those in A.4.7 and A.6.7 shall be tested on any band where 2RX is supported with the antenna connection specified in A.6.3.1.2.4. For single carrier tests specified in section A.4.7 or A.6.7, all tests shall be tested with the antenna connection specified in A.3.6.1.1.2.4 for bands where 2RX is supported, and the antenna connection specified in A.3.6.1.1.2.5 for bands where 4RX is supported.

For 4RX capable UEs which do not support any 2RX band, all tests specified in sections A.4 and A.6 shall be tested using the antenna connection specified in section A.3.6.1.1.2.5. For radio link monitoring tests, the SNR levels are modified according to table A.3.6.1.1.2.1-1 and table A.3.6.1.1.2.1-2

**Table A.3.6.1.1.2.1-1: Modified parameters for RLM out of sync testing with 4 RX antenna connection**

| Test case | SNR during T3 (dB) | | | |
|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | Test 4 |
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**Table A.3.6.1.1.2.1-2: Modified parameters for RLM in sync single carrier testing with 4 RX antenna connection**

| Test case | SNR during T3 (dB) | | SNR during T4 (dB) | |
|---|---|---|---|---|
| | Test 1 | Test 2 | Test 1 | Test 2 |
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### A.3.6.1.1.2.2 Carrier aggregation tests

All carrier aggregation tests are performed using the antenna connection in section A.3.6.1.1.2.4 for the PCell antenna connection if the PCell is on a band where 2RX is supported or the antenna connection in A.3.6.1.1.2.5 for the PCell antenna connection if the PCell is on a band where 4RX is supported.

All carrier aggregation tests are performed using the antenna connection in section A.3.6.1.1.2.4 for the SCell antenna connection if an SCell is on band where 2RX is supported or the testing procedure in A.3.6.1.1.2.5 for the SCell antenna connection if an SCell is on a band where 4RX is supported.

### A.3.6.1.1.2.3 EN-DC tests

All carrier aggregation tests are performed using the antenna connection in section A.3.6.1.1.2.6 for the PCell antenna connection if the PCell is on a band where 2RX is supported or the antenna connection in A.3.6.1.1.2.7 for the PCell antenna connection if the PCell is on a band where 4RX is supported.

All carrier aggregation tests are performed using the antenna connection in section A.3.6.1.1.2.4 for the PSCell or SCell antenna connection if an SCell is on band where 2RX is supported or the testing procedure in A.3.6.1.1.2.5 for the SCell antenna connection if an SCell or PSCell is on a band where 4RX is supported.

### A.3.6.1.1.2.4 Antenna connection for bands where 2RX is supported

For bands where 2RX is supported, it is left to the UE declaration and AP configuration to decide which 2 of the 4 Rx ports are connected with data source from system simulator. The remaning 2 Rx ports shall be connected with zero input**.** No test parameters or requirements are modified.

##### A.3.6.1.1.2.5 Antenna connection for bands where 4RX is supported

For bands where 4RX is supporetd, all 4 Rx are connected with data source from system simulator**.** The system simulator shall provide independent noise and fading (low correlation) for each antenna port. Except for the modifications to radio link monitoring theresholds described in sections A.3.8.1.2.1 and A.3.8.1.2.2, no test parameters or requirements are modified.

##### A.3.6.1.1.2.6 EN-DC LTE Antenna connection for bands where 2RX is supported

For bands where LTE 2RX is supported, it is left to the UE declaration and AP configuration to decide which 2 of the 4 Rx ports are connected with data source from system simulator. The remaning 2 Rx ports shall be connected with zero input**.** No test parameters or requirements are modified.

##### A.3.6.1.1.2.7 EN-DC LTE Antenna connection for bands where 4RX is supported

For bands where LTE 4RX is supported, all 4 Rx are connected with data source from system simulator**.** The system simulator shall provide independent noise and fading (low correlation) for each antenna port. Except for the modifications to radio link monitoring theresholds described in sections A.3.8.1.2.1 and A.3.8.1.2.2, no test parameters or requirements are modified.

### A.3.6.2 Antenna configurations for FR2

Unless otherwise specified, Downlink Antenna Configuration 2x2 for NR RRM FR2 requirements implies the following for the test configuration:

- The downlink signal is transmitted over the two polarizations (V and H) of the dual polarized antenna of the test equipment.
- The downlink signal is received assuming 2 UE baseband receivers. As the UE is tested following the Blackbox Approach with regard to the UE Rx antennas, the exact UE Rx antenna configuration is not relevant for the test configuration and has no impact on the test implementation.

## A.3.7 EN-DC test setup

### A.3.7.1 Introduction

### A.3.7.2 E-UTRAN Serving Cell Parameters

#### A.3.7.2.1 E-UTRAN Serving Cell Parameters for Tests with NR Cell(s) in FR1

Table A.3.7.2.1-1 defines cell specific test parameters for E-UTRAN cell which can be used in EN-DC test cases with all NR cells in FR1.

**Table A.3.7.2.1-1: E-UTRAN cell specific test parameters for tests with all NR cells in FR1**

| Parameter | Unit | E-UTRAN Cell1 |
|---|---|---|
| E-UTRA RF Channel Number | | 1 |
| Duplex mode | | FDD or TDD |
| TDD special subframe configuration[Note1] | | 6 |
| TDD uplink-downlink configuration[Note1] | | 1 |
| $BW_{channel}$ | | 5MHz: $N_{RB,c}$ = 25<br>10MHz: $N_{RB,c}$ = 50<br>20MHz: $N_{RB,c}$ = 100 |
| PDSCH parameters:<br>DL Reference Measurement Channel[Note2] | | 5MHz: R.7 FDD<br>10MHz: R.3 FDD<br>20MHz: R.6 FDD<br>5MHz: R.4 TDD<br>10MHz: R.0 TDD<br>20MHz: R.3 TDD |
| PCFICH/PDCCH/PHICH parameters:<br>DL Reference Measurement Channel[Note2] | | 5MHz: R.11 FDD<br>10MHz: R.6 FDD<br>20MHz: R.10 FDD<br>5MHz: R.11 TDD<br>10MHz: R.6 TDD<br>20MHz: R.10 TDD |
| OCNG Patterns[Note2] | | 5MHz: OP.20 FDD<br>10MHz: OP.10 FDD<br>20MHz: OP.17 FDD<br>5MHz: OP.9 TDD<br>10MHz: OP.1 TDD<br>20MHz: OP.7 TDD |
| PBCH_RA | dB | 0 |
| PBCH_RB | dB | |
| PSS_RA | dB | |
| SSS_RA | dB | |
| PCFICH_RB | dB | |
| PHICH_RA | dB | |
| PHICH_RB | dB | |
| PDCCH_RA | dB | |
| PDCCH_RB | dB | |
| PDSCH_RA | dB | |
| PDSCH_RB | dB | |
| OCNG_RA[Note3] | dB | |
| OCNG_RB[Note3] | dB | |
| $N_{oc}$[Note4] | dBm/15 kHz | -104 |
| $\hat{E}_s/N_{oc}$ | dB | 17 |
| $\hat{E}_s/I_{ot}$ | dB | 17 |
| RSRP [Note5] | dBm/15 kHz | -87 |
| SCH_RP [Note5] | dBm/15 kHz | -87 |
| Io [Note5] | dBm/Ch BW | -59.13<br>+10log<br>($N_{RB,c}$ /50) |
| Propagation Condition | | AWGN |
| Antenna Configuration | | 1x2 |

Note 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211.
Note 2: DL RMCs and OCNG patterns are specified in sections A 3.1 and A 3.2 of TS 36.133 respectively.
Note 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 5: Es/Iot, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

#### A.3.7.2.2 E-UTRAN Serving Cell Parameters for Tests with NR Cell(s) in FR2

Table A.3.7.2.2-1 defines cell specific test parameters for E-UTRAN cell which can be used in EN-DC test cases with one or more NR cells in FR2.

**Table A.3.7.2.2-1: E-UTRAN cell specific test parameters for tests with one or more NR cells in FR2**

| Parameter | Unit | E-UTRAN Cell1 |
|---|---|---|
| E-UTRA RF Channel Number | | 1 |
| Duplex mode | | FDD or TDD |
| TDD special subframe configuration[Note1] | | 6 |
| TDD uplink-downlink configuration[Note1] | | 1 |
| $BW_{channel}$ | MHz | 5MHz: $N_{RB,c}$ = 25<br>10MHz: $N_{RB,c}$ = 50<br>20MHz: $N_{RB,c}$ = 100 |
| PDSCH parameters:<br>DL Reference Measurement Channel[Note2] | | 5MHz: R.7 FDD<br>10MHz: R.3 FDD<br>20MHz: R.6 FDD<br>5MHz: R.4 TDD<br>10MHz: R.0 TDD<br>20MHz: R.3 TDD |
| PCFICH/PDCCH/PHICH parameters:<br>DL Reference Measurement Channel[Note2] | | 5MHz: R.11 FDD<br>10MHz: R.6 FDD<br>20MHz: R.10 FDD<br>5MHz: R.11 TDD<br>10MHz: R.6 TDD<br>20MHz: R.10 TDD |
| OCNG Patterns[Note2] | | 5MHz: OP.20 FDD<br>10MHz: OP.10 FDD<br>20MHz: OP.17 FDD<br>5MHz: OP.9 TDD<br>10MHz: OP.1 TDD<br>20MHz: OP.7 TDD |
| PBCH_RA | dB | 0 |
| PBCH_RB | dB | |
| PSS_RA | dB | |
| SSS_RA | dB | |
| PCFICH_RB | dB | |
| PHICH_RA | dB | |
| PHICH_RB | dB | |
| PDCCH_RA | dB | |
| PDCCH_RB | dB | |
| PDSCH_RA | dB | |
| PDSCH_RB | dB | |
| OCNG_RA[Note3] | dB | |
| OCNG_RB[Note3] | dB | |
| Note 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211.<br>Note 2: DL RMCs and OCNG patterns are specified in sections A 3.1 and A 3.2 of TS 36.133 respectively.<br>Note 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 4: The E-UTRA signal is required only to ensure the E-UTRA link to the DUT in the EN-DC operation. The Test System shall provide a stable and noise-free E-UTRA signal without need of precise propagation modelling, path loss and polarization control. Further details of the E-UTRA signal configuration are not defined as part of the cell specific test parameters, since the E-UTRA link is not under performance verification and is not expected to influence the NR FR2 requirement. | | |

## A.3.8 PRACH configurations

### A.3.8.1 Introduction

This section provides the typical PRACH configurations used for RRM test cases defined in Annex A. To note that for other parameters not listed in this section, either it can be derived from the set up of each test or it is subjected to RAN5 specifications.

## A.3.8.2 PRACH configurations in FR1

### A.3.8.2.1 FR1 PRACH configuration 1

FR1 PRACH configuration 1 in this section provides the typical PRACH configuration for SSB-based contention based random access in FR1.

**Table A.3.8.2.1-1: Parameters for FR1 PRACH configuration 1**

| Field | Value | Comment |
|---|---|---|
| *prach-ConfigurationIndex* | 87 | 160ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6]. |
| *msg1-SubcarrierSpacing* | Same as UL carrier SCS | |
| *totalNumberOfRA-Preambles* | 48 | Total number of preambles used for contention based and contention free random acces |
| *numberOfRA-PreamblesGroupA* | 48 | No group B. |
| *prach-RootSequenceIndex* | 0 | Logic equence index = 0, resulting in root sequence = 1. |
| *ssb-perRACH-OccasionAndCB-PreamblesPerSSB* | oneFourth, n48 | OneFourth: 1 SSB associated with 4 RACH occasions<br>n48: 48 contention based preambles per SSB |
| *msg1-FDM* | One | One PRACH transmission occasions FDMed in one time instance. |
| *rsrp-ThresholdSSB* | RSRP_51 | -106dBm≤ *rsrp-ThresholdSSB* <-105dBm |
| *ra-ContentionResolutionTimer* | sf48 | 48 sub-frames |
| *powerRampingStep* | dB2 | |
| *preambleReceivedTargetPower* | dBm-120 | |
| *preambleTransMax* | n6 | Max number of RA preamble transmission perfomed before declaring a failure is 6 |
| *ra-ResponseWindow* | sl10 | 10 slots |
| *zeroCorrelationZoneConfig* | 11 | N-CS configuration, $N_{CS}$ = 23 |
| Backoff Parameter Index | 2 | 20ms, as defined in table 7.2-1 in TS 38.321 [7]. |
| Note: For further information see Clause 6.3.2 in TS 38.331 [2]. | | |

### A.3.8.2.2 FR1 PRACH configuration 2

FR1 PRACH configuration 2 in this section provides the typical PRACH configuration for SSB based non-contention based random access in FR1.

**Table A.3.8.2.2-1: Parameters for FR1 PRACH configuration 2**

| Field | Value | Comment |
|---|---|---|
| *prach-ConfigurationIndex* | 87 | 160ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6]. |
| *msg1-SubcarrierSpacing* | Same as UL carrier SCS | |
| *totalNumberOfRA-Preambles* | 48 | Total number of preambles used for contention based and contention free random acces |
| *numberOfRA-PreamblesGroupA* | 48 | No group B. |
| *prach-RootSequenceIndex* | 0 | Logic equence index = 0, resulting in root sequence = 1. |
| *ssb-perRACH-Occasion* | oneFourth | OneFourth: 1 SSB associated with 4 RACH occasions |
| *msg1-FDM* | One | One PRACH transmission occasions FDMed in one time instance. |
| *powerRampingStep* | dB2 | |
| *preambleReceivedTargetPower* | dBm-120 | |
| *preambleTransMax* | n6 | Max number of RA preamble transmission perfomed before declaring a failure is 6 |
| *ra-ResponseWindow* | sl10 | 10 slots |
| *zeroCorrelationZoneConfig* | 11 | N-CS configuration, $N_{CS}$ = 23 |
| Backoff Parameter Index | 2 | 20ms, as defined in table 7.2-1 in TS 38.321 [7]. |
| *ssb-ResourceList* | ra-PreambleIndex = 50 | Assocated with SSB index 0 |
| *ra-ssb-OccasionMaskIndex* | 1 | PRACH occasion index 1 is allowed |
| *rsrp-ThresholdSSB* | RSRP_51 | -106dBm≤ *rsrp-ThresholdSSB* <-105dBm |
| Note: For further information see Clause 6.3.2 in TS 38.331 [2]. | | |

## A.3.8.2.3 FR1 PRACH configuration 3

FR1 PRACH configuration 3 in this section provides the typical PRACH configuration for CSI-RS based non-contention based random access in FR1.

**Table A.3.8.2.3-1: Parameters for FR1 PRACH configuration 3**

| Field | Value | Comment |
|---|---|---|
| *prach-ConfigurationIndex* | 87 | 160ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6]. |
| *msg1-SubcarrierSpacing* | Same as UL carrier SCS | |
| *totalNumberOfRA-Preambles* | 48 | Total number of preambles used for contention based and contention free random acces |
| *numberOfRA-PreamblesGroupA* | 48 | No group B. |
| *prach-RootSequenceIndex* | 0 | Logic equence index = 0, resulting in root sequence = 1. |
| *ssb-perRACH-Occasion* | oneFourth | OneFourth: 1 SSB associated with 4 RACH occasions |
| *msg1-FDM* | One | One PRACH transmission occasions FDMed in one time instance. |
| *powerRampingStep* | dB2 | |
| *preambleReceivedTargetPower* | dBm-120 | |
| *preambleTransMax* | n6 | Max number of RA preamble transmission perfomed before declaring a failure is 6 |
| *ra-ResponseWindow* | sl10 | 10 slots |
| *zeroCorrelationZoneConfig* | 11 | N-CS configuration, $N_{CS}$ = 23 |
| Backoff Parameter Index | 2 | 20ms, as defined in table 7.2-1 in TS 38.321 [7]. |
| *csirs-ResourceList* | ra-PreambleIndex = 50 | Assocated with CSI-RS configured |
| *ra-OccasionList* | 1 | RA occasions allowed corresponding to CSI-RS |
| *rsrp-ThresholdCSI-RS* | RSRP_51 | -106dBm≤ *rsrp-ThresholdSSB* <-105dBm |
| Note: For further information see Clause 6.3.2 in TS 38.331 [2]. | | |

## A.3.8.2.4 FR1 PRACH configuration 4

FR1 PRACH configuration 4 in this section provides the typical PRACH configuration for CSI-RS based non-contention based random access in FR1.

**Table A.3.8.2.4-1: Parameters for FR1 PRACH configuration 4**

| Field | Value | Comment |
|---|---|---|
| *prach-ConfigurationIndex* | 0 | 160ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6]. |
| *msg1-SubcarrierSpacing* | Same as UL carrier SCS | |
| *totalNumberOfRA-Preambles* | 48 | Total number of preambles used for contention based and contention free random acces |
| *numberOfRA-PreamblesGroupA* | 48 | No group B. |
| *prach-RootSequenceIndex* | 0 | Logic equence index = 0, resulting in root sequence = 1. |
| *ssb-perRACH-Occasion* | oneFourth | OneFourth: 1 SSB associated with 4 RACH occasions |
| *msg1-FDM* | One | One PRACH transmission occasions FDMed in one time instance. |
| *powerRampingStep* | dB2 | |
| *preambleReceivedTargetPower* | dBm-120 | |
| *preambleTransMax* | n200 | Max number of RA preamble transmission perfomed before declaring a failure is 200 |
| *ra-ResponseWindow* | sl1 | 1 slot |
| *zeroCorrelationZoneConfig* | 11 | N-CS configuration, $N_{CS}$ = 93 |
| Backoff Parameter Index | 2 | 20ms, as defined in table 7.2-1 in TS 38.321 [7]. |
| *csirs-ResourceList* | ra-PreambleIndex = 50 | Assocated with CSI-RS configured |
| *ra-OccasionList* | 1 | RA occasions allowed corresponding to CSI-RS |
| *rsrp-ThresholdCSI-RS* | RSRP_51 | -106dBm≤ *rsrp-ThresholdSSB* <-105dBm |
| Note: For further information see Clause 6.3.2 in TS 38.331 [2]. | | |

# A.3.8.3 PRACH configurations in FR2

## A.3.8.3.1 FR2 PRACH configuration 1

FR2 PRACH configuration 1 in this section provides the typical PRACH configuration for SSB-based contention based random access in FR2.

**Table A.3.8.3.1-1: Parameters for FR2 PRACH configuration 1**

| Field | Value | Comment |
|---|---|---|
| *prach-ConfigurationIndex* | 173 | Preamble Format C2, with 160ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-4 in TS 38.211 [6]. |
| *msg1-SubcarrierSpacing* | Same as UL carrier SCS | |
| *totalNumberOfRA-Preambles* | 48 | Total number of preambles used for contention based and contention free random acces |
| *numberOfRA-PreamblesGroupA* | 48 | No group B. |
| *prach-RootSequenceIndex* | 0 | Logic equence index = 0, resulting in root sequence = 1. |
| *ssb-perRACH-OccasionAndCB-PreamblesPerSSB* | oneFourth, n48 | OneFourth: 1 SSB associated with 4 RACH occasions n48: 48 contention based preambles per SSB |
| *msg1-FDM* | One | One PRACH transmission occasions FDMed in one time instance. |
| *rsrp-ThresholdSSB* | RSRP_51 | -106dBm≤ *rsrp-ThresholdSSB* <-105dBm |
| *ra-ContentionResolutionTimer* | sf48 | 48 sub-frames |
| *powerRampingStep* | dB2 | |
| *preambleReceivedTargetPower* | dBm-120 | |
| *preambleTransMax* | n6 | Max number of RA preamble transmission perfomed before declaring a failure is 6 |
| *ra-ResponseWindow* | sl10 | 10 slots |
| *zeroCorrelationZoneConfig* | 11 | N-CS configuration, $N_{CS}$ = 23 |
| Backoff Parameter Index | 2 | 20ms, as defined in table 7.2-1 in TS 38.321 [7]. |
| Note: For further information see Clause 6.3.2 in TS 38.331 [2]. | | |

## A.3.8.3.2 FR2 PRACH configuration 2

FR2 PRACH configuration 2 in this section provides the typical PRACH configuration for SSB based non-contention based random access in FR2.

**Table A.3.8.3.2-1: Parameters for FR2 PRACH configuration 2**

| Field | Value | Comment |
|---|---|---|
| *prach-ConfigurationIndex* | 173 | Preamble Format C2, with 160ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-4 in TS 38.211 [6]. |
| *msg1-SubcarrierSpacing* | Same as UL carrier SCS | |
| *totalNumberOfRA-Preambles* | 48 | Total number of preambles used for contention based and contention free random acces |
| *numberOfRA-PreamblesGroupA* | 48 | No group B. |
| *prach-RootSequenceIndex* | 0 | Logic equence index = 0, resulting in root sequence = 1. |
| *ssb-perRACH-Occasion* | oneFourth | OneFourth: 1 SSB associated with 4 RACH occasions |
| *msg1-FDM* | One | One PRACH transmission occasions FDMed in one time instance. |
| *powerRampingStep* | dB2 | |
| *preambleReceivedTargetPower* | dBm-120 | |
| *preambleTransMax* | n6 | Max number of RA preamble transmission perfomed before declaring a failure is 6 |
| *ra-ResponseWindow* | sl10 | 10 slots |
| *zeroCorrelationZoneConfig* | 11 | N-CS configuration, $N_{CS}$ = 23 |
| Backoff Parameter Index | 2 | 20ms, as defined in table 7.2-1 in TS 38.321 [7]. |
| *ssb-ResourceList* | ra-PreambleIndex = 50 | Assocated with SSB index 0 |
| *ra-ssb-OccasionMaskIndex* | 1 | PRACH occasion index 1 is allowed |
| *rsrp-ThresholdSSB* | RSRP_51 | -106dBm≤ *rsrp-ThresholdSSB* <-105dBm |
| Note: For further information see Clause 6.3.2 in TS 38.331 [2]. | | |

### A.3.8.3.3 FR2 PRACH configuration 3

FR2 PRACH configuration 3 in this section provides the typical PRACH configuration for CSI-RS based non-contention based random access in FR2.

| Field | Value | Comment |
|---|---|---|
| *prach-ConfigurationIndex* | 173 | Preamble Format C2, with 160ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-4 in TS 38.211 [6]. |
| *msg1-SubcarrierSpacing* | Same as UL carrier SCS | |
| *totalNumberOfRA-Preambles* | 48 | Total number of preambles used for contention based and contention free random acces |
| *numberOfRA-PreamblesGroupA* | 48 | No group B. |
| *prach-RootSequenceIndex* | 0 | Logic equence index = 0, resulting in root sequence = 1. |
| *ssb-perRACH-Occasion* | oneFourth | OneFourth: 1 SSB associated with 4 RACH occasions |
| *msg1-FDM* | One | One PRACH transmission occasions FDMed in one time instance. |
| *powerRampingStep* | dB2 | |
| *preambleReceivedTargetPower* | dBm-120 | |
| *preambleTransMax* | n6 | Max number of RA preamble transmission perfomed before declaring a failure is 6 |
| *ra-ResponseWindow* | sl10 | 10 slots |
| *zeroCorrelationZoneConfig* | 11 | N-CS configuration, $N_{CS}$ = 23 |
| Backoff Parameter Index | 2 | 20ms, as defined in table 7.2-1 in TS 38.321 [7]. |
| *csirs-ResourceList* | ra-PreambleIndex = 50 | Assocated with CSI-RS configured |
| *ra-OccasionList* | 1 | RA occasions allowed corresponding to CSI-RS |
| *rsrp-ThresholdCSI-RS* | RSRP_51 | -106dBm≤ *rsrp-ThresholdSSB* <-105dBm |
| Note: For further information see Clause 6.3.2 in TS 38.331 [2]. | | |

### A.3.8.3.4 FR2 PRACH configuration 4

FR2 PRACH configuration 4 in this section provides the typical PRACH configuration for CSI-RS based non-contention based random access in FR2.

| Field | Value | Comment |
|---|---|---|
| *prach-ConfigurationIndex* | 144 | Preamble Format C0, with 160ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-4 in TS 38.211 [6]. |
| *msg1-SubcarrierSpacing* | Same as UL carrier SCS | |
| *totalNumberOfRA-Preambles* | 48 | Total number of preambles used for contention based and contention free random acces |
| *numberOfRA-PreamblesGroupA* | 48 | No group B. |
| *prach-RootSequenceIndex* | 0 | Logic equence index = 0, resulting in root sequence = 1. |
| *ssb-perRACH-Occasion* | oneFourth | OneFourth: 1 SSB associated with 4 RACH occasions |
| *msg1-FDM* | One | One PRACH transmission occasions FDMed in one time instance. |
| *powerRampingStep* | dB2 | |
| *preambleReceivedTargetPower* | dBm-120 | |
| *preambleTransMax* | n200 | Max number of RA preamble transmission perfomed before declaring a failure is 200. |
| *ra-ResponseWindow* | sl40 | 40 slots |
| *zeroCorrelationZoneConfig* | 11 | N-CS configuration, $N_{CS}$ = 23 |
| Backoff Parameter Index | 2 | 20ms, as defined in table 7.2-1 in TS 38.321 [7]. |
| *csirs-ResourceList* | ra-PreambleIndex = 50 | Assocated with CSI-RS configured |
| *ra-OccasionList* | 1 | RA occasions allowed corresponding to CSI-RS |
| *rsrp-ThresholdCSI-RS* | RSRP_51 | -106dBm≤ *rsrp-ThresholdSSB* <-105dBm |
| Note: For further information see Clause 6.3.2 in TS 38.331 [2]. | | |

# A.3.9 BWP configurations

## A.3.9.1 Introduction

This section provides the typical BWP configurations used for RRM test cases defined in Annex A. For downlink BWP, both initial BWP and dedicated BWP configurations are specified in section A.3.9.2 and for uplink BWP, both initial BWP and dedicated BWP configurations are specified in section A.3.9.3. To note that for other parameters not listed in this section, either it can be derived from the set up of each test or it is subjected to RAN5 specifications.

## A.3.9.2 Downlink BWP configurations

### A.3.9.2.1 Initial BWP

**Table A.3.9.2.1-1: Downlink BWP patterns for initial BWP configuration**

| BWP Parameters | Unit | Values | | |
|---|---|---|---|---|
| Reference BWP | | DLBWP.0.1 | DLBWP.0.2 | |
| Starting PRB index | | 0 | $RB_a$ Note 1 | |
| Bandwidth | RB | Same as RF channel defined in each test | same as RMSI CORSET(CORSET #0) defined in each test | |
| Note 1: $RB_a$ is the lowest PRB index to guarantee the BWP including SSB PRB index ($RB_J$, $RB_{J+1}$,…., $RB_{J+19}$) which is defined in Section A.3.10. | | | | |

#### A.3.9.2.2 Dedicated BWP

**Table A.3.9.2.2-1: Downlink BWP patterns for dedicated BWP configuration**

| BWP Parameters | Unit | Values | | |
|---|---|---|---|---|
| Reference BWP | | DLBWP.1.1 | DLBWP.1.2 | DLBWP.1.3 |
| Starting PRB index | | 0 | $RB_b$ Note 1 | $RB_a$ Note 2 |
| Bandwidth | RB | Same as RF channel defined in each test | 25 for SCS = 15KHz,<br>51 for SCS = 30KHz,<br>32 for SCS = 120KHz | 25 for SCS = 15KHz,<br>51 for SCS = 30KHz,<br>32 for SCS = 120KHz |
| Note 1: $RB_b$ is the lowest PRB index to guarantee the BWP not fully overlapped with SSB PRB index ($RB_J$, $RB_{J+1}$,…., $RB_{J+19}$) which is defined in Section A.3.10.<br>Note 2: $RB_a$ is the lowest PRB index to guarantee the BWP including SSB PRB index ($RB_J$, $RB_{J+1}$,…., $RB_{J+19}$) which is defined in Section A.3.10. | | | | |

### A.3.9.3 Uplink BWP configurations

#### A.3.9.3.1 Initial BWP

**Table A.3.9.3.1-1: Uplink BWP patterns for initial BWP configuration**

| BWP Parameters | Unit | Values | | |
|---|---|---|---|---|
| Reference BWP | | ULBWP.0.1 | ULBWP.0.2 | |
| Starting PRB index | | 0 | $RB_a$ Note 1 | |
| Bandwidth | RB | Same as RF channel defined in each test | same as RMSI CORSET(CORSET #0) defined in each test | |
| Note 1: $RB_a$ is the lowest PRB index to guarantee the BWP including SSB PRB index ($RB_J$, $RB_{J+1}$,…., $RB_{J+19}$) which is defined in Section A.3.10. | | | | |

#### A.3.9.3.2 Dedicated BWP

**Table A.3.9.3.2-1: Uplink BWP patterns for dedicated BWP configuration**

| BWP Parameters | Unit | Values | | |
|---|---|---|---|---|
| Reference BWP | | ULBWP.1.1 | ULBWP.1.2 | ULBWP.1.3 |
| Starting PRB index | | 0 | $RB_b$ Note 1 | $RB_a$ Note 2 |
| Bandwidth | RB | Same as RF channel defined in each test | 25 for SCS = 15KHz,<br>51 for SCS = 30KHz,<br>32 for SCS = 120KHz | 25 for SCS = 15KHz,<br>51 for SCS = 30KHz,<br>32 for SCS = 120KHz |
| Note 1: $RB_b$ is the lowest PRB index to guarantee the BWP not fully overlapped with SSB PRB index ($RB_J$, $RB_{J+1}$,…., $RB_{J+19}$) which is defined in Section A.3.10.<br>Note 2: $RB_a$ is the lowest PRB index to guarantee the BWP including SSB PRB index ($RB_J$, $RB_{J+1}$,…., $RB_{J+19}$) which is defined in Section A.3.10. | | | | |

# A.3.10 SSB Configurations

## A.3.10.1 SSB Configurations for FR1

### A.3.10.1.1 SSB pattern 1 in FR1: SSB for SSB SCS=15 KHz in 10 MHz

**Table A.3.10.1.1-1: SSB.1 FR1: SSB Pattern 1 for SSB SCS=15 KHz in 10 MHz channel**

| SSB Parameters | Values |
|---|---|
| Channel bandwidth | 10 MHz |
| SSB SCS | 15 KHz |
| SSB periodicity | 20 ms |
| Number of SSBs per SS-burst | 1 |
| SS/PBCH block index | 0 |
| Indices of symbols containing SSB | 2-5 |
| Indices of slots containing SSB | 0 |
| RB numbers containing SSB within channel BW | ($RB_J$, $RB_{J+1}$,…., $RB_{J+19}$)[Note 1] |
| Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. | |

### A.3.10.1.2 SSB pattern 2 in FR1: SSB allocation for SSB SCS=30 KHz in 40 MHz

**Table A.3.10.1.2-1: SSB.2 FR1: SSB Pattern 2 for SSB SCS=30 KHz in 40 MHz channel**

| SSB Parameters | Values |
|---|---|
| Channel bandwidth | 40 MHz |
| SSB SCS | 30 KHz |
| SSB periodicity | 20 ms |
| Number of SSBs per SS-burst | 1 |
| SS/PBCH block index | 0 |
| Indices of symbols containing SSB | 4-7 |
| Indices of of slots containing SSB | 0 |
| RB numbers containing SSB within channel BW | ($RB_J$, $RB_{J+1}$,…., $RB_{J+19}$)[Note 1] |
| Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. | |

### A.3.10.1.3 SSB pattern 1 in FR1: SSB for SSB SCS=15 KHz in 10 MHz

**Table A.3.10.1.3-1: SSB.3 FR1: SSB Pattern 3 for SSB SCS=15 KHz in 10 MHz channel**

| SSB Parameters | Values | |
|---|---|---|
| Channel bandwidth | 10 MHz | |
| SSB SCS | 15 KHz | |
| SSB periodicity | 20 ms | |
| Number of SSBs per SS-burst | 2 | |
| SS/PBCH block index | 0 | 1 |
| Symbol numbers of symbols containing SSB | 2-5 | 8-11 |
| RB numbers containing SSB within channel BW | 0-19 | |

#### A.3.10.1.4 SSB pattern 4 in FR1: SSB allocation for SSB SCS=30 KHz in 40 MHz

**Table A.3.10.1.4-1: SSB.4 FR1: SSB Pattern 4 for SSB SCS=30 KHz in 40 MHz channel**

| SSB Parameters | Values | |
|---|---|---|
| Channel bandwidth | 40 MHz | |
| SSB SCS | 30 KHz | |
| SSB periodicity | 20 ms | |
| Number of SSBs per SS-burst | 2 | |
| SS/PBCH block index | 0 | 1 |
| Symbol numbers of symbols containing SSB | 2-5 | 8-11 |
| RB numbers containing SSB within channel BW | 0-19 | |

### A.3.10.2 SSB Configurations for FR2

#### A.3.10.2.1 SSB pattern 1 in FR2: SSB allocation for SSB SCS=120 KHz in 100 MHz

**Table A.3.10.2.1-1: SSB.1 FR2: SSB Pattern 1 for SSB SCS = 120 KHz in 100 MHz channel with 2 SSBs per SS-burst**

| SSB Parameters | Values | |
|---|---|---|
| Channel bandwidth | 100 MHz | |
| SSB SCS | 120 KHz | |
| SSB periodicity | 20 ms | |
| Number of SSBs per SS-burst | 2 | |
| SS/PBCH block index | 0 | 1 |
| Indices of symbols containing SSBs | 4-7 | 8-11 |
| Indices of slots containing SSB | 0 | 0 |
| RB numbers containing SSBs within channel BW | $(RB_J, RB_{J+1},\ldots, RB_{J+19})$ Note 1 | |
| Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. | | |

#### A.3.10.2.2 SSB pattern 2 in FR2: SSB allocation for SSB SCS=240 KHz in 100 MHz

**Table A.3.10.2.2-1: SSB.2 FR2: SSB Pattern 2 for SSB SCS = 240 KHz in 100 MHz channel with 2 SSBs per SS-burst**

| SSB Parameters | Values | |
|---|---|---|
| Channel bandwidth | 100 MHz | |
| SSB SCS | 240 KHz | |
| SSB periodicity | 20 ms | |
| Number of SSBs per SS-burst | 2 | |
| SS/PBCH block index | 0 | 1 |
| Indices of symbols containing SSBs | 8-11 | 12-13, 0-1 |
| Indices of slots containing SSB | 0 | 0, 1 |
| RB numbers containing SSBs within channel BW | $(RB_J, RB_{J+1},\ldots, RB_{J+19})$ Note 1 | |
| Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. | | |

#### A.3.10.2.3 SSB pattern 3 in FR2: SSB allocation for SSB SCS=120 KHz in 100 MHz

**Table A.3.10.2.3-1: SSB.3 FR2: SSB Pattern 3 for SSB SCS = 120 KHz in 100 MHz channel with 1 SSB per SS-burst**

| SSB Parameters | Values |
|---|---|
| Channel bandwidth | 100 MHz |
| SSB SCS | 120 KHz |
| SSB periodicity | 20 ms |
| Number of SSBs per SS-burst | 1 |
| SS/PBCH block index | 0 |
| Indices of symbols containing SSBs | 4-7 |
| Indices of slots containing SSB | 0 |
| RB numbers containing SSBs within channel BW | $(RB_J, RB_{J+1},\ldots, RB_{J+19})^{\text{Note 1}}$ |
| Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. | |

#### A.3.10.2.4 SSB pattern 4 in FR2: SSB allocation for SSB SCS=240 KHz in 100 MHz

**Table A.3.10.2.4-1: SSB.4 FR2: SSB Pattern 4 for SSB SCS = 240 KHz in 100 MHz channel with 1 SSB per SS-burst**

| SSB Parameters | Values |
|---|---|
| Channel bandwidth | 100 MHz |
| SSB SCS | 240 KHz |
| SSB periodicity | 20 ms |
| Number of SSBs per SS-burst | 1 |
| SS/PBCH block index | 0 |
| Indices of symbols containing SSBs | 8-11 |
| Indices of slots containing SSB | 0 |
| RB numbers containing SSBs within channel BW | $(RB_J, RB_{J+1},\ldots, RB_{J+19})^{\text{Note 1}}$ |
| Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. | |

## A.3.11 SMTC Configurations

### A.3.11.1 SMTC pattern 1: SMTC period = 20 ms with SMTC duration = 1 ms

**Table A.3.11.1-1: SMTC.1: SMTC Pattern 1 for SMTC period = 20 ms and duration = 1 ms**

| SMTC Parameters | Values |
|---|---|
| SMTC periodicity | 20 ms |
| SMTC offset | 0 ms |
| SMTC duration | 1 ms |

### A.3.11.2 SMTC pattern 2: SMTC period = 20 ms with SMTC duration = 5 ms

**Table A.3.11.2-1: SMTC.2: SMTC Pattern 2 for SMTC period = 20 ms and duration = 5 ms**

| SMTC Parameters | Values |
|---|---|
| SMTC periodicity | 20 ms |
| SMTC offset | 0 ms |
| SMTC duration | 5 ms |

# A.3.12 Test Cases with Different CC Configurations

## A.3.12.1 EN-DC Test Cases with Different EN-DC Configurations

### A.3.12.1.1 Introduction

In Annex A EN-DC test cases may be defined for two component carriers (CCs) as well as for more than two CCs to verify the same RRM requirement.

### A.3.12.1.2 Principle of testing

If multiple EN-DC test cases are defined for two CCs as well as for more than two CCs to verify the same type of RRM requirement, which depends on the number of CCs, then from the UE performance point of view the test coverage can be considered fulfilled by executing only the EN-DC test cases with the maximum number of CCs in EN-DC supported by the UE. Otherwise if the same type of RRM requirement is independent of the number of CCs then from the UE performance point of view the test coverage can be considered fulfilled by executing only the EN-DC test cases with two CCs in EN-DC supported by the UE.

*Editor's: The maximum number of CCs that can be used in FR2 tests in EN-DC would depend on the test equipment capability.*

## A.3.12.2 Carrier Aggregation Test Cases with Different CA Configurations

### A.3.12.2.1 Introduction

In Annex A carrier aggregation test cases may be defined for two CCs as well as for more than two CCs to verify the same RRM requirement.

### A.3.12.2.2 Principle of testing

If multiple carrier aggregation test cases are defined for two CCs as well as for more than two CCs to verify the same RRM requirement, which depends on the number of CCs, then from the UE performance point of view the test coverage can be considered fulfilled by executing only the CA test cases with the maximum number of CCs in CA supported by the UE. Otherwise if the same type of RRM requirement is independent of the number of CCs then from the UE performance point of view the test coverage can be considered fulfilled by executing only the CA test cases with at least two CCs in CA supported by the UE.

*Editor's: The maximum number of CCs that can be used in FR2 tests in CA would depend on the test equipment capability.*

# A.3.13 Test Cases in Standalone and Non-Standalone Operations

## A.3.13.1 Introduction

This clause defines a principle which is applicable to test cases verifying RRM requirements in standalone (SA) or EN-DC operations.

In Annex A test cases may be defined in SA and EN-DC operations to verify the same RRM requirement.

## A.3.13.2 Principle of Testing

If test cases are defined in both SA and EN-DC operations to verify the same RRM requirement then the UE capable of both SA and EN-DC operations needs to verify that RRM requirement by performing test case(s) in either SA operation or in EN-DC operation.

If test cases are defined in both SA and EN-DC operations to verify at least one common RRM requirement then the UE capable of both SA and EN-DC operations needs to verify RRM requirements by performing test case(s) in either SA operation or in EN-DC operation provided that the performed test case(s):

- verifies the largest number of RRM requirements and
- verifies at least all RRM requirements covered in the test case(s), which is not performed.

# A.3.14 CSI-RS configurations

## A.3.14.1 FDD

**Table A.3.14.1-1: CSI-RS Reference Measurement Channels for SCS=15kHz**

| **Parameter** | | **Unit** | **value** | | | |
|---|---|---|---|---|---|---|
| **Reference channel** | | | CSI-RS.1.1 FDD | CSI-RS.1.2 FDD | CSI-RS.1.3 FDD | |
| Bandwidth | | MHz | 10 | 10 | 10 | |
| SCS | | kHz | 15 | 15 | 15 | |
| NZP CSI-RS | resourceType | | periodic | periodic | periodic | |
| | Number of ports | | 2 | 1 | 1 | |
| | CDM Type | | FD-CDM2 | noCDM | noCDM | |
| | Density | | 1 | 3 | 3 | |
| | firstOFDMSymbolInTimeDomain | | 5 | 5 | 5 | |
| | frequencyDomainAllocation | | 000001 | 000001 | 000001 | |
| | period | slot | TBD | TBD | TBD | |
| | offset | slot | TBD | TBD | TBD | |
| | EPRE ratio to SSS | dB | 0 | 0 | 0 | |
| CSI-IM | subcarrierLocation-p0 | | s0 | N/A | N/A | |
| | symbolLocation-p0 | | 6 | | | |
| | period | slot | TBD | | | |
| | offset | slot | TBD | | | |
| ReportConfigType | | | periodic | Periodic | Periodic | |
| CQI-table | | | Table 1 | N/A | N/A | |
| reportQuantity | | | TBD | cri-RSRP | cri-RSRP | |
| timeRestrictionForInterferenceMeasurements | | | configured | N/A | N/A | |
| cqi-FormatIndicator | | | Wideband | | | |
| pmi-FormatIndicator | | | Wideband | | | |
| CodebookType | | | Type1 single panel | | | |
| CodebookMode | | | 1 | | | |
| TypeI-SinglePanel-2Tx-CodebookSubsetRestriction | | | 111111 | | | |
| Physical channel for CSI report | | | PUCCH | PUCCH | PUCCH | |
| Reporting interval | | ms | 10 | TBD | TBD | |
| CQI/RI/PMI delay | | ms | TBD | N/A | N/A | |

## A.3.14.2 TDD

**Table A.3.14.2-1: CSI-RS Reference Measurement Channels for SCS=15kHz**

<table>
<tr><th colspan="2">Parameter</th><th>Unit</th><th colspan="4">value</th></tr>
<tr><td colspan="2">Reference channel</td><td></td><td>CSI-RS.1.1 TDD</td><td>CSI-RS.1.2 TDD</td><td>CSI-RS.1.3 TDD</td><td></td></tr>
<tr><td colspan="2">Bandwidth</td><td>MHz</td><td>10</td><td>10</td><td>10</td><td></td></tr>
<tr><td colspan="2">SCS</td><td>kHz</td><td>15</td><td>15</td><td>15</td><td></td></tr>
<tr><td rowspan="9">NZP CSI-RS</td><td>resourceType</td><td></td><td>periodic</td><td>periodic</td><td>periodic</td><td></td></tr>
<tr><td>Number of ports</td><td></td><td>2</td><td>1</td><td>1</td><td></td></tr>
<tr><td>CDM Type</td><td></td><td>FD-CDM2</td><td>noCDM</td><td>noCDM</td><td></td></tr>
<tr><td>Density</td><td></td><td>1</td><td>3</td><td>3</td><td></td></tr>
<tr><td>firstOFDMSymbolInTimeDomain</td><td></td><td>5</td><td>5</td><td>5</td><td></td></tr>
<tr><td>frequencyDomainAllocation</td><td></td><td>000001</td><td>000001</td><td>000001</td><td></td></tr>
<tr><td>period</td><td>slot</td><td>TBD</td><td>TBD</td><td>TBD</td><td></td></tr>
<tr><td>offset</td><td>slot</td><td>TBD</td><td>TBD</td><td>TBD</td><td></td></tr>
<tr><td>EPRE ratio to SSS</td><td>dB</td><td>0</td><td>0</td><td>0</td><td></td></tr>
<tr><td rowspan="4">CSI-IM</td><td>subcarrierLocation-p0</td><td></td><td>s0</td><td rowspan="4">N/A</td><td rowspan="4">N/A</td><td></td></tr>
<tr><td>symbolLocation-p0</td><td></td><td>6</td><td></td></tr>
<tr><td>period</td><td>slot</td><td>TBD</td><td></td></tr>
<tr><td>offset</td><td>slot</td><td>TBD</td><td></td></tr>
<tr><td colspan="2">ReportConfigType</td><td></td><td>periodic</td><td>Periodic</td><td>Periodic</td><td></td></tr>
<tr><td colspan="2">CQI-table</td><td></td><td>Table 1</td><td>N/A</td><td>N/A</td><td></td></tr>
<tr><td colspan="2">reportQuantity</td><td></td><td>TBD</td><td>cri-RSRP</td><td>cri-RSRP</td><td></td></tr>
<tr><td colspan="2">timeRestrictionForInterferenceMeasurements</td><td></td><td>configured</td><td rowspan="6">N/A</td><td rowspan="6">N/A</td><td></td></tr>
<tr><td colspan="2">cqi-FormatIndicator</td><td></td><td>Wideband</td><td></td></tr>
<tr><td colspan="2">pmi-FormatIndicator</td><td></td><td>Wideband</td><td></td></tr>
<tr><td colspan="2">CodebookType</td><td></td><td>Type1 single panel</td><td></td></tr>
<tr><td colspan="2">CodebookMode</td><td></td><td>1</td><td></td></tr>
<tr><td colspan="2">TypeI-SinglePanel-2Tx-CodebookSubsetRestriction</td><td></td><td>111111</td><td></td></tr>
<tr><td colspan="2">Physical channel for CSI report</td><td></td><td>PUCCH</td><td>PUCCH</td><td>PUCCH</td><td></td></tr>
<tr><td colspan="2">Reporting interval</td><td>ms</td><td>10</td><td>TBD</td><td>TBD</td><td></td></tr>
<tr><td colspan="2">CQI/RI/PMI delay</td><td>ms</td><td>TBD</td><td>N/A</td><td>N/A</td><td></td></tr>
</table>

**Table A.3.14.2-2: CSI-RS Reference Measurement Channels for SCS=30kHz**

| **Parameter** | | **Unit** | **value** | | | |
|---|---|---|---|---|---|---|
| **Reference channel** | | | CSI-RS.2.1 TDD | CSI-RS.2.2 TDD | CSI-RS.2.3 TDD | |
| Bandwidth | | MHz | 40 | 40 | 40 | |
| SCS | | kHz | 30 | 30 | 30 | |
| NZP CSI-RS | resourceType | | periodic | periodic | periodic | |
| | Number of ports | | 2 | 1 | 1 | |
| | CDM Type | | FD-CDM2 | noCDM | noCDM | |
| | Density | | 1 | 3 | 3 | |
| | firstOFDMSymbolInTimeDomain | | 5 | 5 | 5 | |
| | frequencyDomainAllocation | | 000001 | 000001 | 000001 | |
| | period | slot | TBD | TBD | TBD | |
| | offset | slot | TBD | TBD | TBD | |
| | EPRE ratio to SSS | dB | 0 | 0 | 0 | |
| CSI-IM | subcarrierLocation-p0 | | s0 | N/A | N/A | |
| | symbolLocation-p0 | | 6 | | | |
| | period | slot | TBD | | | |
| | offset | slot | TBD | | | |
| ReportConfigType | | | periodic | Periodic | Periodic | |
| CQI-table | | | Table 1 | N/A | N/A | |
| reportQuantity | | | TBD | cri-RSRP | cri-RSRP | |
| timeRestrictionForInterferenceMeasurements | | | configured | N/A | N/A | |
| cqi-FormatIndicator | | | Wideband | | | |
| pmi-FormatIndicator | | | Wideband | | | |
| CodebookType | | | Type1 single panel | | | |
| CodebookMode | | | 1 | | | |
| TypeI-SinglePanel-2Tx-CodebookSubsetRestriction | | | 111111 | | | |
| Physical channel for CSI report | | | PUCCH | PUCCH | PUCCH | |
| Reporting interval | | ms | 10 | TBD | TBD | |
| CQI/RI/PMI delay | | ms | TBD | N/A | N/A | |

**Table A.3.14.2-3: CSI-RS Reference Measurement Channels for SCS=120kHz**

| Parameter | | Unit | value | | | |
|---|---|---|---|---|---|---|
| **Reference channel** | | | CSI-RS.3.1 TDD | CSI-RS.3.2 TDD | CSI-RS.3.3 TDD | |
| Bandwidth | | MHz | 100 | 100 | 100 | |
| SCS | | kHz | 120 | 120 | 120 | |
| NZP CSI-RS | resourceType | | periodic | periodic | periodic | |
| | Number of ports | | 2 | 1 | 1 | |
| | CDM Type | | FD-CDM2 | noCDM | noCDM | |
| | Density | | 1 | 3 | 3 | |
| | firstOFDMSymbolInTimeDomain | | 5 | 5 | 5 | |
| | frequencyDomainAllocation | | 000001 | 000001 | 000001 | |
| | period | slot | TBD | TBD | TBD | |
| | offset | slot | TBD | TBD | TBD | |
| | EPRE ratio to SSS | dB | 0 | 0 | 0 | |
| CSI-IM | subcarrierLocation-p0 | | s0 | N/A | N/A | |
| | symbolLocation-p0 | | 6 | | | |
| | period | slot | TBD | | | |
| | offset | slot | TBD | | | |
| ReportConfigType | | | periodic | Periodic | Periodic | |
| CQI-table | | | Table 1 | N/A | N/A | |
| reportQuantity | | | TBD | cri-RSRP | cri-RSRP | |
| timeRestrictionForInterferenceMeasurements | | | configured | N/A | N/A | |
| cqi-FormatIndicator | | | Wideband | | | |
| pmi-FormatIndicator | | | Wideband | | | |
| CodebookType | | | Type1 single panel | | | |
| CodebookMode | | | 1 | | | |
| TypeI-SinglePanel-2Tx-CodebookSubsetRestriction | | | 111111 | | | |
| Physical channel for CSI report | | | PUCCH | PUCCH | PUCCH | |
| Reporting interval | | ms | 10 | TBD | TBD | |
| CQI/RI/PMI delay | | ms | TBD | N/A | N/A | |

# A.3.15 Angle of Arrival (AoA) for FR2 RRM test cases

This clause specifies the AoA setups for FR2 RRM test cases in section A.5 and A.7. The applicable AoA setup is defined in each test case in section A.5 and A.7.

## A.3.15.1 Setup 1: Single AoA in Rx beam peak direction

There is only one probe in the test. The DL signals, and noise if applicable, transmitted from the probe are aligned to the UE Rx beam peak direction (as defined in 38.101-2 [19]).

# A.4 EN-DC tests with PSCell in FR1

## A.4.1 Void

## A.4.2 Void

## A.4.3 RRC_CONNECTED state mobility

### A.4.3.1 Void

### A.4.3.2 RRC Connection Mobility Control

#### A.4.3.2.1 Void

#### A.4.3.2.2 Random Access

##### A.4.3.2.2.1 Contention based random access test in FR1 for PSCell in EN-DC

###### A.4.3.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.2 and Clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in section A.3.7.2.1 and Cell 2 configured as PSCell in FR1. Supported test parameters are shown in Table A.4.3.2.2.1.1-1. UE capble of EN-DC with PSCell in FR1 needs to be tested by using the parameters in Table A.4.3.2.2.1.1-2.

**Table A.4.3.2.2.1.1-1: Supported test configurations for contention based random access test in FR1 for PSCell in EN-DC**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 3 | LTE FDD, NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability | |

**Table A.4.3.2.2.1.1-2: General test parameters for contention based random access test in FR1 for PSCell in EN-DC**

| Parameter | | | Unit | Test-1 | Comments |
|---|---|---|---|---|---|
| SSB Configuration | Config 1,2 | | | SSB pattern 1 in FR1 | As defined in A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below |
| | Config 3,4 | | | SSB pattern 2 in FR1 | |
| Number of SSBs per SS-burst | | | | 2 | Different from the definition in A.3.10 |
| SS/PBCH block index | | | | 0,1 | Different from the definition in A.3.10 |
| Duplex Mode for Cell 2 | Config 1,2 | | | FDD | |
| | Config 3,4 | | | TDD | |
| TDD Configuration | Config 3,4 | | | TDDConf.1.2 | |
| OCNG Pattern Note 1 | | | | OCNG pattern 1 | As defined in A.3.2.1. |
| PDSCH parameters Note 4 | Config 1,2 | | | SR1.1 FDD | As defined in A.3.1.1. |
| | Config 3,4 | | | SR2.1 TDD | |
| NR RF Channel Number | | | | 1 | |
| EPRE ratio of PSS to SSS | | | dB | 0 | |
| EPRE ratio of PBCH_DMRS to SSS | | | dB | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | dB | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | dB | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | dB | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | dB | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | dB | | |
| SSB with index 0 | $\hat{E}_s/I_{ot}$ | | dB | 3 | SSB with index 0 is signalled to be above configured *rsrp-ThresholdSSB* |
| | $N_{oc}$ | Config 1,2 | dBm/15kHz | -98 | |
| | | Config 3,4 | | -101 | |
| | $\hat{E}_s/N_{oc}$ | | dB | 3 | |
| | SS-RSRP Note 3 | | dBm/ SCS | -95 | |
| SSB with index 1 | $\hat{E}_s/I_{ot}$ | | dB | -17 | SSB with index 1 is signalled to be below configured *rsrp-ThresholdSSB* |
| | $N_{oc}$ | Config 1,2 | dBm/15kHz | -98 | |
| | | Config 3,4 | | -101 | |
| | $\hat{E}_s/N_{oc}$ | | dB | -17 | |
| | SS-RSRP Note 3 | | dBm/ SCS | -115 | |
| Io Note 2 | Config 1,2 | | dBm | -65.3/9.36MHz | For symbols without SSB index 1 |
| | Config 3,4 | | | -62.2/38.16MHz | |
| ss-PBCH-BlockPower | | | dBm/ SCS | -5 | As defined in clause 6.3.2 in TS 38.331 [2]. |
| Configured UE transmitted power ($P_{\text{CMAX, f,c}}$) | | | dBm | 23 | As defined in clause 6.2.4 in TS 38.101-1. |
| PRACH Configuration | | | | FR1 PRACH configuration 1 | As defined in A.3.8.2. |
| Propagation Condition | | | - | AWGN | |

Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
Note 2: Io level has been derived from other parameters for information purpose. It is not a settable parameter.
Note 3: RSRP level has been derived from other parameters for information purposes. It is not a settable parameter.
Note 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

### A.4.3.2.2.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

###### A.4.3.2.2.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in Subclause 6.2.2.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.4.3.2.2.1.2.2 Random Access Response Reception

To test the UE behavior specified in Subclause 6.2.2.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.4.3.2.2.1.2.3 No Random Access Response Reception

To test the UE behavior specified in subclause 6.2.2.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.4.3.2.2.1.2.4 Receiving a NACK on msg3

To test the UE behavior specified in subclause 6.2.2.2.1.4 the System Simulator shall NACK *all* UE msg3 following a successful Random Access Response.

The UE shall re-transmit the msg3 upon the reception of a NACK on msg3 until the maximum number of HARQ re-transmissions is reached.

###### A.4.3.2.2.1.2.5 Reception of an Incorrect Message over Temporary C-RNTI

To test the UE behavior specified in Subclause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element *not* matching the CCCH SDU transmitted in msg3 uplink message.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

#### A.4.3.2.2.1.2.6 Reception of a Correct Message over Temporary C-RNTI

To test the UE behavior specified in Subclause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element matching the CCCH SDU transmitted in the msg3 uplink message.

The UE shall send ACK if the Contention Resolution is successful.

#### A.4.3.2.2.1.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in Subclause 6.2.2.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

### A.4.3.2.2.2 Non-contention based random access test in FR1 for PSCell in EN-DC

#### A.4.3.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.2 and Clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in section A.3.7.2.1 and Cell 2 configured as PSCell in FR1. Supported test parameters are shown in Table A.4.3.2.2.2.1-1. UE capble of EN-DC with PSCell in FR1 needs to be tested by using the parameters in Table A.4.3.2.2.2.1-2 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2).

**Table A.4.3.2.2.2.1-1: Supported test configurations for non-contention based random access test in FR1 for PSCell in EN-DC**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 3 | LTE FDD, NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability | |

**Table A.4.3.2.2.2.1-2: General test parameters for non-contention based random access test in FR1 for PSCell in EN-DC**

| Parameter | | | Unit | Test-1 | Test-2 | Comments |
|---|---|---|---|---|---|---|
| SSB Configuration | | Config 1,2 | | SSB pattern 1 in FR1 | SSB pattern 1 in FR1 | As defined in A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below |
| | | Config 3,4 | | SSB pattern 2 in FR1 | SSB pattern 2 in FR1 | |
| Number of SSBs per SS-burst | | | | 2 | 2 | Different from the definition in A.3.10 |
| SS/PBCH block index | | | | 0,1 | 0,1 | Different from the definition in A.3.10 |
| CSI-RS Configuration | | Config 1,2 | | N/A | CSI-RS.1.1 FDD | As defined in A.3.1.4 |
| | | Config 3,4 | | | CSI-RS.2.1 TDD | |
| Duplex Mode for Cell 2 | | Config 1,2 | | FDD | FDD | |
| | | Config 3,4 | | TDD | TDD | |
| TDD Configuration | | Config 3,4 | | TDDConf.1.2 | TDDConf.1.2 | |
| OCNG Pattern Note 1 | | | | OCNG pattern 1 | OCNG pattern 1 | As defined in A.3.2.1. |
| PDSCH parameters Note 4 | | Config 1,2 | | SR1.1 FDD | SR1.1 FDD | As defined in A.3.1.1. |
| | | Config 3,4 | | SR2.1 TDD | SR2.1 TDD | |
| NR RF Channel Number | | | | 1 | 1 | |
| EPRE ratio of PSS to SSS | | | dB | 0 | 0 | |
| EPRE ratio of PBCH_DMRS to SSS | | | dB | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | dB | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | dB | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | dB | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | dB | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | dB | | | |
| SSB with index 0 | $\hat{E}_s/I_{ot}$ | | dB | 3 | 3 | SSB with index 0 is signalled to be above configured *rsrp-ThresholdSSB* |
| | $N_{oc}$ | Config 1,2 | dBm/15kHz | -98 | -98 | |
| | | Config 3,4 | | -101 | -101 | |
| | $\hat{E}_s/N_{oc}$ | | dB | 3 | 3 | |
| | SS-RSRP Note 3 | | dBm/ SCS | -95 | -95 | |
| SSB with index 1 | $\hat{E}_s/I_{ot}$ | | dB | -17 | -17 | SSB with index 1 is signalled to be below configured *rsrp-ThresholdSSB* |
| | $N_{oc}$ | Config 1,2 | dBm/15kHz | -98 | -98 | |
| | | Config 3,4 | | -101 | -101 | |
| | $\hat{E}_s/N_{oc}$ | | dB | -17 | -17 | |
| | SS-RSRP Note 3 | | dBm/ SCS | -115 | -115 | |
| Io Note 2 | | Config 1,2 | dBm | -65.3/9.36MHz | -65.3/9.36MHz | For symbols without SSB index 1 |
| | | Config 3,4 | | -62.2/38.16MHz | -62.2/38.16MHz | |
| ss-PBCH-BlockPower | | | dBm/ SCS | -5 | -5 | As defined in clause 6.3.2 in TS 38.331 [2]. |
| Configured UE transmitted power ( $P_{\text{CMAX, f,c}}$ ) | | | dBm | 23 | 23 | As defined in clause 6.2.4 in TS 38.101-1. |
| PRACH Configuration | | | | FR1 PRACH configuration 2 | FR1 PRACH configuration 3 | As defined in A.3.8.2. |
| Propagation Condition | | | - | AWGN | AWGN | |

Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
Note 2: Io level has been derived from other parameters for information purpose. It is not a settable parameter.
Note 3: RSRP level has been derived from other parameters for information purposes. It is not a settable parameter.
Note 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

###### A.4.3.2.2.2.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

###### A.4.3.2.2.2.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in Subclause 6.2.2.2.2.1 for SSB-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2.. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.4.3.2.2.2.2.2 CSI-RS-based Random Access Preamble Transmission

In Test-2, to test the UE behavior specified in Subclause 6.2.2.2.2.1 for CSI-RS-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the CSI-RS configured.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-OccasionList*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.4.3.2.2.2.2.3 Random Access Response Reception

To test the UE behavior specified in Subclause 6.2.2.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.4.3.2.2.2.2.4 No Random Access Response Reception

To test the UE behavior specified in subclause 6.2.2.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

#### A.4.3.2.3 Void

## A.4.4 Timing

### A.4.4.1 UE transmit timing

#### A.4.4.1.1 NR UE Transmit Timing Test for FR1

##### A.4.4.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1.2. Supported test configurations are shown in Table 4.4.1.1.1-1.

**Table A.4.4.1.1.1-1: Supported test configurations for FR1 PSCell**

| Configuration | Description |
|---|---|
| 1 | FDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 2 | TDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 3 | TDD, SSB SCS 30 KHz, data SCS 30KHz, BW 40MHz |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

For this test a single NR cell is used. Table A.4.4.1.1.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in Table A.4.4.1.1.1-3.

**Table A.4.4.1.1.1-2: Cell Specific Test Parameters for UL Transmit Timing test**

| Parameter | Unit | Config | Test1 | Test2 | Band Group |
|---|---|---|---|---|---|
| SSB ARFCN | | 1,2,3 | Freq1 | Freq1 | |
| Duplex Mode | | 1 | FDD | | |
| | | 2,3 | TDD | | |
| TDD configuration | | 1` | Not Applicable | | |
| | | 2 | TDDConf.1.1 | | |
| | | 3 | TDDConf.1.2 | | |
| $BW_{channel}$ | MHz | 1 | 10: NRB,c = 52 | | |
| | | 2 | 10: $N_{RB,c}$ = 52 | | |
| | | 3 | 40: $N_{RB,c}$ = 106 | | |
| BWP BW | MHz | 1 | 10: NRB,c = 52 | | |
| | | 2 | 10: $N_{RB,c}$ = 52 | | |
| | | 3 | 40: $N_{RB,c}$ = 106 | | |
| DRx Cycle | ms | 1,2,3 | N/A | 320[Note5] | |
| PDSCH Reference measurement channel | | 1 | SR.1.1 FDD | | |
| | | 2 | SR.1.1 TDD | | |
| | | 3 | SR.2.1 TDD | | |
| CORESET Reference Channel | | 1 | CR.1.1 FDD | | |
| | | 2 | CR.1.1 TDD | | |

| | | | | | |
|---|---|---|---|---|---|
| | | 3 | CR.2.1 TDD | | |
| OCNG Patterns | | 1,2,3 | OCNG pattern 1 | | |
| SMTC configuration | | 1,2 | FR1 pattern 1 | | |
| | | 3 | FR1 pattern 2 | | |
| PDSCH/PDCCH subcarrier spacing | kHz | 1,2 | 15 | | |
| | | 3 | 30 | | |
| EPRE ratio of PSS to SSS | dB | 1,23 | 0 | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | |
| $N_{oc}$ Note2 | dBm/15 kHz | 1,2,3 | -98 | -98 | |
| $N_{oc}$ Note2 | dBm/SCS | 1,2 | -98 | -98 | |
| | | 3 | -95 | -95 | |
| $\hat{E}_s/I_{ot}$ | | 1,2,3 | 3 | 3 | |
| $\hat{E}_s/N_{oc}$ | | 1,2,3 | 3 | 3 | |
| SS-RSRP Note3 | dBm/SCS | 1,2 | -95 | -95 | |
| | | 3 | -92 | -92 | |
| Io Note3 | dBm/9.36MHz | 1,2 | -65.2 | -65.2 | |
| | dBm/38.1MHz | 3 | -59.2 | -59.2 | |
| Propagation condition | | 1,2,3 | AWGN | | |
| SRS Config | | 1,2,3 | Config1 Note6 | Config2 Note6 | |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: DRx related parameters are given in Table A.4.4.1.1.1-4
Note 6: SRS configs are given in Table A.4.4.1.1.1-3

### Table A.4.4.1.1.1-3 SRS Configuration for Timing Accuracy Test

| | Field | Config1 | Config 2 | Comments |
|---|---|---|---|---|
| SRS-ResourceSet | srs-ResourceSetId | 0 | 0 | |
| | srs-ResourceIdList | 0 | 0 | |
| | resourceType | Periodic | Periodic | |
| | Usage | Codebook | Codebook | |
| | SRS-ResourceSetId | 0 | 0 | |
| SRS-Resource | nrofSRS-Ports | Port1 | Port1 | |
| | transmissionComb | n2 | n2 | |
| | combOffset-n2 | 0 | 0 | |
| | cyclicShift-n2 | 0 | 0 | |
| | resourceMapping startPosition | 0 | 0 | |

| | | | | |
|---|---|---|---|---|
| | resourceMapping nrofSymbols | n1 | n1 | |
| | resourceMapping repetitionFactor | n1 | n1 | |
| | freqDomainPosition | 0 | 0 | |
| | freqDomainShift | 0 | 0 | |
| | freqHopping c-SRS | sl1 | sl1 | |
| | freqHopping b-SRS | 0 | 0 | |
| | freqHopping b-hop | 0 | 0 | |
| | groupOrSequenceHopping | Neither | Neither | |
| | resourceType | Periodic | Periodic | |
| | periodicityAndOffset-p | sl1 | sl640 | Offset to align with DRx periodicity |
| | sequenceId | 0 | 0 | Any 10 bit number |

**Table A.4.4.1.1.1-4: DRX-Configuration for UL Timing Tests**

| Field | Test 2 |
|---|---|
| | Value |
| drx-onDurationTimer | TBD |
| drx-InactivityTimer | TBD |
| drx-RetransmissionTimerDL | TBD |
| drx-RetransmissionTimerUL | TBD |
| longDRX-CycleStartOffset | TBD |
| shortDRX | TBD |

### A.4.4.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Set up E-UTRA PCell according to parameters given in Table A.3.7.2.1-1 and setup NR PSCell according to parameters given in Table A.4.4.1.1.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within ($N_{TA}$ + $N_{TA\_offset}$) ± $T_e$ of the first detected path of DL SSB.

   a. The $N_{TA}$ offset value (in $T_c$ units) is 25600 for FR1 and 13792 for FR2

   b. The $T_e$ values depend on the DL and UL SCS for which the test is being run and are given in Table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in Table A.4.4.1.1.2-1

**Table A.4.4.1.1.2-1: Adjustment Value for DL Timing**

| SCS of SSB signals (KHz) | Adjustment Value | |
|---|---|---|
| | Test1 | Test2 |
| 15 | +64*64$T_c$ | +32*64$T_c$ |
| 30 | +32*64$T_c$ | +16*64$T_c$ |
| 120 | +16*64$T_c$ | +8*64$T_c$ |
| 240 | +8*64$T_c$ | +4*64$T_c$ |

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in Section 7.1.2 Table 7.1.2-3. This will only be done for Test1.

5) The test system shall verify that the UE transmit timing offset stays within ($N_{TA}$ + $N_{TA\_offset}$) ± $T_e$ of the first detected path of DL SSB. For Test 2 and Test 4 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

## A.4.4.2 UE timer accuracy

## A.4.4.3 Timing advance

### A.4.4.3.1 EN-DC FR1 timing advance adjustment accuracy

#### A.4.4.3.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

#### A.4.4.3.1.2 Test Parameters

Supported test configurations are shown in table A.4.4.3.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.4.4.3.1.2-2, A.4.4.3.1.2-3 and A.4.4.3.1.2-4. The configuration of Cell 1 (LTE PCell) is specified in section A.3.7.2.1.

In all test cases, two cells are used. Cell 1 is the PCell in the primary Timing Advance Group (pTAG) and cell 2 is the PSCell is in the secondary Timing Advance Group (sTAG). Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands for sTAG are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.4.4.3.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured for PSCell in sTAG.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element for sTAG, as specified in Clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to Clause 4.2 in TS 38.213 results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance for sTAG used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements for sTAG, with Timing Advance Command value specified in table A.4.4.3.1.2-2. This value shall result in changes of the timing advance for sTAG used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in Clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in Clause 5.2 in TS 38.321, shall be configured so that it does not expire in the duration of the test.

**Table A.4.4.3.1.2-1: Timing advance supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.4.4.3.1.2-2: General test parameters for timing advance**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF channel number | | Cell 1: 1<br>Cell 2: 2 | 1 for E-UTRAN PCell<br>2 for NR PSCell |
| DL BWP | | DLBWP.1.1 | As specified in Table A.3.9.2.1-1 |
| UL BWP | | ULBWP.1.1 | As specified in Table A.3.9.2.2-1 |
| TRS | | TBD | TBD |
| Timing Advance Command ($T_A$) value during T1 | | 31 | $N_{TA\_new} = N_{TA\_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2 |
| Timing Advance Command ($T_A$) value during T2 | | 39 | $N_{TA\_new} = N_{TA\_old} + 8192*T_c$ (based on equation in TS 38.213 [3] section 4.2) |
| T1 | s | 5 | |
| T2 | s | 5 | |

**Table A.4.4.3.1.2-3: Cell specific test parameters for timing advance**

| Parameter | Unit | Test1 | |
|---|---|---|---|
| | | T1 | T2 |

| | | | |
|---|---|---|---|
| Duplex mode | Config 1,4 | | FDD |
| | Config 2,3,5,6 | | TDD |
| TDD configuration | Config 1,4 | | Not Applicable |
| | Config 2,5 | | TDDConf.1.1 |
| | Config 3,6 | | TDDConf.2.1 |
| $BW_{channel}$ | Config 1,4 | MHz | 10: $N_{RB,c}$ = 52 |
| | Config 2,5 | | 10: $N_{RB,c}$ = 52 |
| | Config 3,6 | | 40: $N_{RB,c}$ = 106 |
| BWP BW | Config 1,4 | MHz | 10: $N_{RB,c}$ = 52 |
| | Config 2,5 | | 10: $N_{RB,c}$ = 52 |
| | Config 3,6 | | 40: $N_{RB,c}$ = 106 |
| DRx Cycle | | ms | Not Applicable |
| PDSCH Reference measurement channel | Config 1,4 | | SR.1.1 FDD |
| | Config 2,5 | | SR.1.1 TDD |
| | Config 3,6 | | SR2.1 TDD |
| CORESET Reference Channel | Config 1,4 | | CR.1.1 FDD |
| | Config 2,5 | | CR.1.1 TDD |
| | Config 3,6 | | CR2.1 TDD |
| OCNG Patterns | | | OCNG pattern 1 |
| SMTC configuration | Config 1,2,4,5 | | SMTC.1 FR1 |
| | Config 3,6 | | SMTC.2 FR1 |
| PDSCH/PDCCH subcarrier spacing | Config 1,2,4,5 | kHz | 15 kHz |
| | Config 3,6 | | 30 kHz |
| PUCCH/PUSCH subcarrier spacing | Config 1,2,4,5 | kHz | 15 kHz |
| | Config 3,6 | | 30 kHz |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | |
| EPRE ratio of PDSCH to PDSCH | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| $N_{oc}$ Note2 | | dBm/15kHz | -98 |
| $N_{oc}$ Note2 | Config 1,2,4,5 | dBm/SCS | -98 |
| | Config 3,6 | | -95 |
| $\hat{E}_s/I_{ot}$ | | dB | 3 |
| $\hat{E}_s/N_{oc}$ | | dB | 3 |
| Io Note3 | Config 1,2,4,5 | dBm/ 9.36MHz | -67.57 |
| | Config 3,6 | dBm/ 38.16MHz | -62.58 |
| Propagation condition | | - | AWGN |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

**Table A.4.4.3.1.2-4: Sounding Reference Symbol Configuration for timing advance**

| Field | | Value | Comment |
|---|---|---|---|
| c-SRS | Config 1,2,4,5 | 12 | Frequency hopping is disabled |
| | Config 3,6 | 24 | |
| b-SRS | | 0 | |
| b-hop | | 0 | |
| freqDomainPosition | | 0 | Frequency domain position of SRS |
| freqDomainShift | | 0 | |
| groupOrSequenceHopping | | neither | No group or sequence hopping |
| SRS-PeriodicityAndOffset | | sl5=0 | Once every 5 slots |
| pathlossReferenceRS | | ssb-Index=0 | SSB #0 is used for SRS path loss estimation |
| usage | | nonCodebook | Non-codebook based UL transmission |
| startPosition | | 0 | resourceMapping setting. SRS on last symbol of slot, and 1symbols for SRS without repetition. |
| nrofSymbols | | n1 | |
| repetitionFactor | | n1 | |
| combOffset-n2 | | 0 | transmissionComb setting |
| cyclicShift-n2 | | 0 | |
| nrofSRS-Ports | | port1 | Number of antenna ports used for SRS transmission |
| Note: For further information see clause 6.3.2 in TS 38.331 [2]. | | | |

#### A.4.4.3.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value for PSCell in sTAG to the transmission timing at the designated activation time i.e. $k$ slots after the reception of the timing advance command, where:

$k$ = 4 for Config 1, 2, 4, 5, and

$k$ = 7 for Config 3, 6

The Timing Advance adjustment accuracy for PSCell in sTAG shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90%.

# A.4.5 Signaling characteristics

## A.4.5.1 Radio link Monitoring

In the following section, any uplink signal transmitted by the UE is used for detecting the In-/Out-of-Sync state of the UE. In terms of measurement, the uplink signal is verified on the basis of the UE output power:

For intra-band contiguous carrier aggregation, transmit OFF power is measured as the mean power per component carrier.

For UE with multiple transmit antennas, transmit OFF power is measured as the mean power at each transmit connector.

- UE output power higher than Transmit OFF power [-50] dBm (as defined in TS 38.101-3 [TBD]) means uplink signal
- UE output power equal to or less than Transmit OFF power [-50] dBm (as defined in TS 38.101-3 [TBD]) means no uplink signal.

#### A.4.5.1.1 Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with SSB-based RLM RS in non-DRX mode

##### A.4.5.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell. This test will partly verify the FR1 PSCell radio link monitoring requirements in clause 8.1.

Supported test configurations are shown in table A.4.5.1.1.1-1. The test parameters are given in Tables A.4.5.1.1.1-2, A.4.5.1.1.1-3, and A.4.5.1.1.1-4 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.4.5.1.1.1-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms) in test 2.

*Editor note: whether to revise power level to be gradually changed*

*Editor note: whether to revise the SSB configuration to be 2 SSBs and FFS the corresponding power level*

**Table A.4.5.1.1.1-1: Supported test configurations for FR1 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 15 KHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 KHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30 KHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 KHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 KHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30 KHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.4.5.1.1.1-2: General test parameters for FR1 out-of-sync testing in non-DRX mode**

| Parameter | | Unit | Value Test 1 | Value Test 2 |
|---|---|---|---|---|
| Active E-UTRA PCell | | | Cell 1 | Cell 1 |
| E-UTRA RF Channel Number | | | 1 | 1 |
| Active PSCell | | | Cell 2 | Cell 2 |
| RF Channel Number | | | 2 | 2 |
| Duplex mode | Config 1, 4 | | FDD | FDD |
| | Config 2, 3, 5, 6 | | TDD | TDD |
| TDD Configuration | Config 1, 4 | | Not Applicable | Not Applicable |
| | Config 2, 5 | | [TDDConf.1.1] | [TDDConf.1.1] |
| | Config 3, 6 | | [TDDConf.1.2] | [TDDConf.1.2] |
| CORESET Reference Channel | Config 1, 4 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] |
| | Config 2, 5 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] |
| | Config 3, 6 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] |
| SSB Configuration | Config 1, 4 | | Table A.3.2.2.1.1-1 | Table A.3.2.2.1.1-1 |
| | Config 2, 5 | | Table A.3.2.2.1.1-1 | Table A.3.2.2.1.1-1 |
| | Config 3, 6 | | Table A.3.2.2.1.2-1 | Table A.3.2.2.1.2-1 |
| SMTC Configuration | Config 1, 2, 4, 5 | | Table A.3.2.3.1-1 | Table A.3.2.3.1-1 |
| | Config 3, 6 | | Table A.3.2.3.1-1 | Table A.3.2.3.1-1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2, 4, 5 | | 15 KHz | 15 KHz |
| | Config 3, 6 | | 30 KHz | 30 KHz |
| PRACH Configuration | Config 1, 2, 4, 5 | | TBD | TBD |
| | Config 3, 6 | | TBD | TBD |
| SSB index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | Table A.3.2.1.1-1 | Table A.3.2.1.1-1 |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *OFF* | *OFF* |
| Gap pattern ID | | | [N.A.] | *[*gp0*]* |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | TBD | TBD |
| ZP CSI-RS configuration | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1, 2, 4, 5 | slot | [5] | [5] |
| | Config 3, 6 | | [10] | [10] |
| T1 | | s | 1 | 1 |

| | | | |
|---|---|---|---|
| T2 | s | 0.4 | 0.4 |
| T3 | s | [0.6] | [0.6] |
| D1 | s | [0.24] | [0.44] |
| Note 1: All configurations are assigned to the UE prior to the start of time period T1.<br>Note 2: UE-specific PDCCH is not transmitted after T1 starts.<br>Note 3: E-UTRAN is in non-DRX mode under test. | | | |

**Table A.4.5.1.1.1-3: Cell specific test parameters for FR1 (Cell 2) for out-of-sync radio link monitoring tests in non-DRX mode**

| Parameter | | Unit | Test 1 | | | Test 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1, 4 | dB | [1] | [-7] | [-15] | [1] | [-7] | [-15] |
| | Config 2, 5 | | [1] | [-7] | [-15] | [1] | [-7] | [-15] |
| | Config 3, 6 | | [1] | [-7] | [-15] | [1] | [-7] | [-15] |
| $N_{oc}$ | Config 1, 4 | dBm/15KHz | [-98] | | | [-98] | | |
| | Config 2, 5 | | [-98] | | | [-98] | | |
| | Config 3, 6 | | [-98] | | | [-98] | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | [TDL-C 300ns 100Hz] | | |
| Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.4.5.1.1.1-1.<br>Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6]. | | | | | | | | |

**Table A.4.5.1.1.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |
| Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap). | |

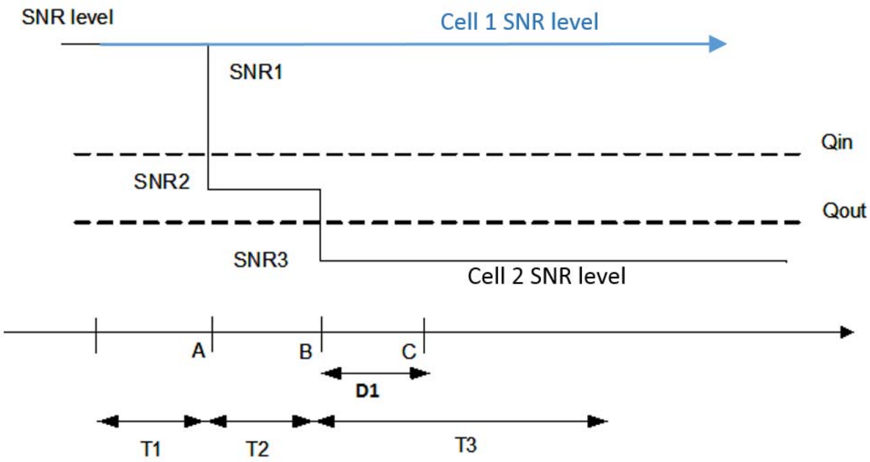


**Figure A.4.5.1.1.1-1: SNR variation for out-of-sync testing**

#### A.4.5.1.1.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

### A.4.5.1.2 Radio Link Monitoring In-sync Test for FR1 PSCell configured with SSB-based RLM RS in non-DRX mode

#### A.4.5.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell. This test will partly verify the FR1 PSCell radio link monitoring requirements in clause 8.1.

Supported test configurations are shown in table A.4.5.1.2.1-1. The test parameters are given in Tables A.4.5.1.2.1-2, A.4.5.1.2.1-3, and A.4.5.1.2.1-4 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.1.2.1-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms) in test 2.

*Editor note: whether to revise power level to be gradually changed*

*Editor note: whether to revise the SSB configuration to be 2 SSBs and FFS the corresponding power level*

**Table A.4.5.1.2.1-1: Supported test configurations for FR1 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 15 KHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 KHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30 KHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 KHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 KHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30 KHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.4.5.1.2.1-2: General test parameters for FR1 in-sync testing in non-DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 1 | Test 2 |
| Active E-UTRA PCell | | | Cell 1 | Cell 1 |
| E-UTRA RF Channel Number | | | 1 | 1 |
| Active PSCell | | | Cell 2 | Cell 2 |
| RF Channel Number | | | 2 | 2 |
| Duplex mode | Config 1, 4 | | FDD | FDD |
| | Config 2, 3, 5, 6 | | TDD | TDD |
| TDD Configuration | Config 1, 4 | | Not Applicable | Not Applicable |
| | Config 2, 5 | | [TDDConf.1.1] | [TDDConf.1.1] |
| | Config 3, 6 | | [TDDConf.1.2] | [TDDConf.1.2] |
| CORESET Reference Channel | Config 1, 4 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] |
| | Config 2, 5 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] |
| | Config 3, 6 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] |
| SSB Configuration | Config 1, 4 | | Table A.3.2.2.1.1-1 | Table A.3.2.2.1.1-1 |
| | Config 2, 5 | | Table A.3.2.2.1.1-1 | Table A.3.2.2.1.1-1 |
| | Config 3, 6 | | Table A.3.2.2.1.2-1 | Table A.3.2.2.1.2-1 |
| SMTC Configuration | Config 1, 2, 4, 5 | | Table A.3.2.3.1-1 | Table A.3.2.3.1-1 |
| | Config 3, 6 | | Table A.3.2.3.1-1 | Table A.3.2.3.1-1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2, 4, 5 | | 15 KHz | 15 KHz |
| | Config 3, 6 | | 30 KHz | 30 KHz |
| PRACH Configuration | Config 1, 2, 4, 5 | | TBD | TBD |
| | Config 3, 6 | | TBD | TBD |
| SSB index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | Table A.3.2.1.1-1 | Table A.3.2.1.1-1 |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| In sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 4 | 4 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 0 | 0 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 0 | 0 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 4 | 4 |

| | | | | |
|---|---|---|---|---|
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *OFF* | *OFF* |
| Gap pattern ID | | | [N.A.] | *[*gp0*]* |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | 2000 | 2000 |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | TBD | TBD |
| ZP CSI-RS configuration | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1, 2, 4, 5 | slot | [5] | [5] |
| | Config 3, 6 | | [10] | [10] |
| T1 | | s | 0.5 | 0.5 |
| T2 | | s | 0.4 | 0.4 |
| T3 | | s | [1.46] | [1.36] |
| T4 | | s | 0.4 | 0.4 |
| T5 | | s | [1] | [1] |
| D1 | | s | [0.42] | [0.72] |
| Note 1: All configurations are assigned to the UE prior to the start of time period T1.<br>Note 2: UE-specific PDCCH is not transmitted after T1 starts.<br>Note 3: E-UTRAN is in non-DRX mode under test. | | | | |

**Table A.4.5.1.2.1-3: Cell specific test parameters for FR1 (Cell 2) for in-sync radio link monitoring tests in non-DRX mode**

| Parameter | | Unit | Test 1 | | | | | Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| PDCCH_beta | | dB | 4 | | | | | 4 | | | | |
| PDCCH_DMRS_beta | | dB | 4 | | | | | 4 | | | | |
| PBCH_beta | | dB | 0 | | | | | 0 | | | | |
| PSS_beta | | dB | | | | | | | | | | |
| SSS_beta | | dB | | | | | | | | | | |
| PDSCH_beta | | dB | | | | | | | | | | |
| OCNG_beta | | dB | | | | | | | | | | |
| SNR | Config 1, 4 | dB | [1] | [-7] | [-15] | [-4.5] | [1] | [1] | [-7] | [-15] | [-4.5] | [1] |
| | Config 2, 5 | | [1] | [-7] | [-15] | [-4.5] | [1] | [1] | [-7] | [-15] | [-4.5] | [1] |
| | Config 3, 6 | | [1] | [-7] | [-15] | [-4.5] | [1] | [1] | [-7] | [-15] | [-4.5] | [1] |
| $N_{oc}$ | Config 1, 4 | dBm/15 KHz | [-98] | | | | | [-98] | | | | |
| | Config 2, 5 | | [-98] | | | | | [-98] | | | | |
| | Config 3, 6 | | [-98] | | | | | [-98] | | | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | | | [TDL-C 300ns 100Hz] | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.4.5.1.2.1-1.<br>Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in section [A.3.6]. | | | | | | | | | | | | |

**Table A.4.5.1.2.1-4: Measurement gap configuration for in-sync tests in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [TBD] |
| Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap). | |

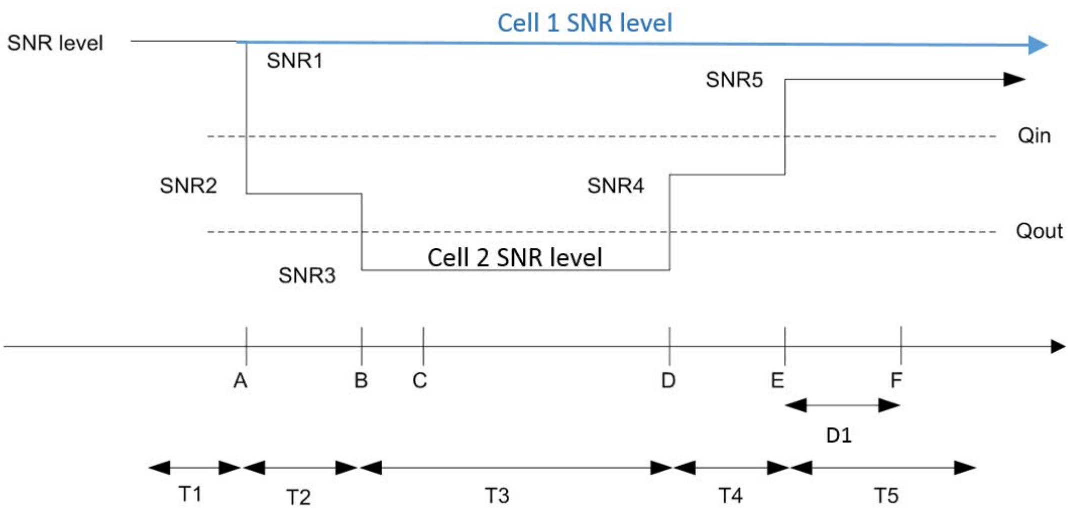


**Figure A.4.5.1.2.1-1: SNR variation for in-sync testing**

#### A.4.5.1.2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

### A.4.5.1.3 Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with SSB-based RLM RS in DRX mode

#### A.4.5.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

Supported test configurations are shown in table A.4.5.1.3.1-1. The test parameters are given in Tables A.4.5.1.3.1-2, A.4.5.1.3.1-3, A.4.5.1.3.1-4, and A.4.5.1.3.1-5. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.4.5.1.3.1-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

*Editor note: whether to revise power level to be gradually changed*

*Editor note: whether to revise the SSB configuration to be  SSBs and FFS the corresponding power level*

**Table A.4.5.1.3.1-1: Supported test configurations for FR1 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 15 KHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 KHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30 KHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 KHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 KHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30 KHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.4.5.1.3.1-2: General test parameters for FR1 out-of-sync testing in DRX mode**

| Parameter | | Unit | Value Test 1 |
|---|---|---|---|
| Active E-UTRA PCell | | | Cell 1 |
| E-UTRA RF Channel Number | | | 1 |
| Active PSCell | | | Cell 2 |
| RF Channel Number | | | 2 |
| Duplex mode | Config 1, 4 | | FDD |
| | Config 2, 3, 5, 6 | | TDD |
| TDD Configuration | Config 1, 4 | | Not Applicable |
| | Config 2, 5 | | [TDDConf.1.1] |
| | Config 3, 6 | | [TDDConf.1.2] |
| CORESET Reference Channel | Config 1, 4 | | [CR. 1.1 FDD] |
| | Config 2, 5 | | [CR. 1.1 TDD] |
| | Config 3, 6 | | [CR. 2.1 TDD] |
| SSB Configuration | Config 1, 4 | | Table A.3.2.2.1.1-1 |
| | Config 2, 5 | | Table A.3.2.2.1.1-1 |
| | Config 3, 6 | | Table A.3.2.2.1.2-1 |
| SMTC Configuration | Config 1, 2, 4, 5 | | Table A.3.2.3.1-1 |
| | Config 3, 6 | | Table A.3.2.3.1-1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2, 4, 5 | | 15 KHz |
| | Config 3, 6 | | 30 KHz |
| PRACH Configuration | Config 1, 2, 4, 5 | | TBD |
| | Config 3, 6 | | TBD |
| SSB index assigned as RLM RS | | | [0] |
| OCNG parameters | | | Table A.3.2.1.1-1 |
| CP length | | | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 |
| | Number of Control OFDM symbols | | 2 |
| | Aggregation level | CCE | 8 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 4 |
| | DMRS precoder granularity | | REG bundle size |
| | REG bundle size | | 6 |
| DRX cycle | | ms | 640 |
| Gap pattern ID | | | [N.A.] |
| Layer 3 filtering | | | *Enabled* |
| T310 timer | | ms | *0* |
| T311 timer | | ms | 1000 |
| N310 | | | 1 |
| N311 | | | 1 |
| NZP CSI-RS configuration | | | TBD |
| ZP CSI-RS configuration | | | TBD |
| CSI-IM configuration | | | TBD |
| Periodic CSI reporting | | | PUCCH |
| CSI reporting periodicity | Config 1, 2, 4, 5 | slot | [5] |
| | Config 3, 6 | | [10] |
| T1 | | s | 1 |
| T2 | | s | 0.4 |
| T3 | | s | [7] |
| D1 | | s | [6.44] |

| | |
|---|---|
| Note 1: | All configurations are assigned to the UE prior to the start of time period T1. |
| Note 2: | UE-specific PDCCH is not transmitted after T1 starts. |
| Note 3: | E-UTRAN is in non-DRX mode under test. |

**Table A.4.5.1.3.1-3: Cell specific test parameters for FR1 (Cell 2) for out-of-sync radio link monitoring tests in DRX mode.**

| Parameter | | Unit | Test 1 | | |
|---|---|---|---|---|---|
| | | | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | |
| PBCH_beta | | dB | 0 | | |
| PSS_beta | | dB | | | |
| SSS_beta | | dB | | | |
| PDSCH_beta | | dB | | | |
| OCNG_beta | | dB | | | |
| SNR | Config 1, 4 | dB | [1] | [-7] | [-15] |
| | Config 2, 5 | | [1] | [-7] | [-15] |
| | Config 3, 6 | | [1] | [-7] | [-15] |
| $N_{oc}$ | Config 1, 4 | dBm/15 KHz | [-98] | | |
| | Config 2, 5 | | [-98] | | |
| | Config 3, 6 | | [-98] | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | |

Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.4.5.1.3.1-1.
Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.4.5.1.3.1-4: DRX-Configuration for out-of-sync tests.**

| Field | Test 1 |
|---|---|
| | Value |
| drx-onDurationTimer | [ms6] |
| drx-InactivityTimer | [ms1] |
| drx-RetransmissionTimerDL | [sl1] |
| drx-RetransmissionTimerUL | [sl1] |
| longDRX-CycleStartOffset | [ms640] |
| shortDRX | disable |

**Table A.4.5.1.3.1-5: TimeAlignmentTimer-Configuration for out-of-sync tests.**

| Field | | Test 1 |
|---|---|---|
| | | Value |
| TimeAlignmentTimer | | infinity |
| periodicityAndOffset in SchedulingRequestResourceConfig | Config 1, 2, 4, 5 | [sl5] |
| | Config 3, 6 | [sl10] |

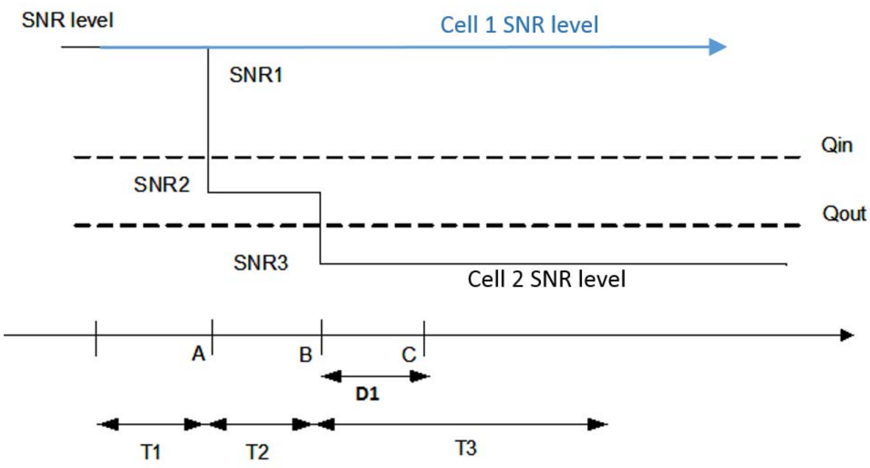


**Figure A.4.5.1.3.1-1: SNR variation for out-of-sync testing.**

#### A.4.5.1.3.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

### A.4.5.1.4 Radio Link Monitoring In-sync Test for FR1 PSCell configured with SSB-based RLM RS in DRX mode

#### A.4.5.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

Supported test configurations are shown in table A.4.5.1.4.1-1. The test parameters are given in Tables A.4.5.1.4.1-2, A.4.5.1.4.1-3, A.4.5.1.4.1-4 and A.4.5.1.4.1-5. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.1.4.1-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

*Editor note: whether to revise power level to be gradually changed*

*Editor note: whether to revise the SSB configuration to be 2 SSBs and FFS the corresponding power level*

**Table A.4.5.1.4.1-1: Supported test configurations for FR1 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 15 KHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 KHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30 KHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 KHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 KHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30 KHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.4.5.1.4.1-2: General test parameters for FR1 in-sync testing in DRX mode**

| Parameter | | Unit | Value<br>Test 1 |
|---|---|---|---|
| Active E-UTRA PCell | | | Cell 1 |
| E-UTRA RF Channel Number | | | 1 |
| Active PSCell | | | Cell 2 |
| RF Channel Number | | | 2 |
| Duplex mode | Config 1, 4 | | FDD |
| | Config 2, 3, 5, 6 | | TDD |
| TDD Configuration | Config 1, 4 | | Not Applicable |
| | Config 2, 5 | | [TDDConf.1.1] |
| | Config 3, 6 | | [TDDConf.1.2] |
| CORESET Reference Channel | Config 1, 4 | | [CR. 1.1 FDD] |
| | Config 2, 5 | | [CR. 1.1 TDD] |
| | Config 3, 6 | | [CR. 2.1 TDD] |
| SSB Configuration | Config 1, 4 | | Table A.3.2.2.1.1-1 |
| | Config 2, 5 | | Table A.3.2.2.1.1-1 |
| | Config 3, 6 | | Table A.3.2.2.1.2-1 |
| SMTC Configuration | Config 1, 2, 4, 5 | | Table A.3.2.3.1-1 |
| | Config 3, 6 | | Table A.3.2.3.1-1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2, 4, 5 | | 15 KHz |
| | Config 3, 6 | | 30 KHz |
| PRACH Configuration | Config 1, 2, 4, 5 | | TBD |
| | Config 3, 6 | | TBD |
| SSB index assigned as RLM RS | | | [0] |
| OCNG parameters | | | Table A.3.2.1.1-1 |
| CP length | | | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] |
| In sync transmission parameters | DCI format | | 1-0 |
| | Number of Control OFDM symbols | | 2 |
| | Aggregation level | CCE | 4 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 0 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 0 |
| | DMRS precoder granularity | | REG bundle size |
| | REG bundle size | | 6 |
| Out of sync transmission parameters | DCI format | | 1-0 |
| | Number of Control OFDM symbols | | 2 |
| | Aggregation level | CCE | 8 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 4 |
| | DMRS precoder granularity | | REG bundle size |
| | REG bundle size | | 6 |
| DRX cycle | | ms | 40 |
| Gap pattern ID | | | [N.A.] |
| Layer 3 filtering | | | *Enabled* |
| T310 timer | | ms | 2000 |
| T311 timer | | ms | 1000 |

| | | | |
|---|---|---|---|
| N310 | | | 1 |
| N311 | | | 1 |
| NZP CSI-RS configuration | | | TBD |
| ZP CSI-RS configuration | | | TBD |
| CSI-IM configuration | | | TBD |
| Periodic CSI reporting | | | PUCCH |
| CSI reporting periodicity | Config 1, 2, 4, 5 | slot | [5] |
| | Config 3, 6 | | [10] |
| T1 | | s | 4 |
| T2 | | s | 1.6 |
| T3 | | s | [1.36] |
| T4 | | s | 0.4 |
| T5 | | s | 0.4 |
| D1 | | s | [1] |
| Note 1: All configurations are assigned to the UE prior to the start of time period T1.<br>Note 2: UE-specific PDCCH is not transmitted after T1 starts.<br>Note 3: E-UTRAN is in non-DRX mode under test. | | | |

**Table A.4.5.1.4.1-3: Cell specific test parameters for FR1 (Cell 2) for in-sync radio link monitoring tests in DRX mode**

| Parameter | | Unit | Test 1 | | | | |
|---|---|---|---|---|---|---|---|
| | | | **T1** | **T2** | **T3** | **T4** | **T5** |
| PDCCH_beta | | dB | 4 | | | | |
| PDCCH_DMRS_beta | | dB | 4 | | | | |
| PBCH_beta | | dB | 0 | | | | |
| PSS_beta | | dB | | | | | |
| SSS_beta | | dB | | | | | |
| PDSCH_beta | | dB | | | | | |
| OCNG_beta | | dB | | | | | |
| SNR | Config 1, 4 | dB | [1] | [-7] | [-15] | [-4.5] | [1] |
| | Config 2, 5 | | [1] | [-7] | [-15] | [-4.5] | [1] |
| | Config 3, 6 | | [1] | [-7] | [-15] | [-4.5] | [1] |
| $N_{oc}$ | Config 1, 4 | dBm/15 KHz | [-98] | | | | |
| | Config 2, 5 | | [-98] | | | | |
| | Config 3, 6 | | [-98] | | | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.4.5.1.4.1-1.<br>Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in section [A.3.6]. | | | | | | | |

**Table A.4.5.1.4.1-4: DRX-Configuration for in-sync tests**

| Field | Test 1 |
|---|---|
| | **Value** |
| drx-onDurationTimer | [ms6] |
| drx-InactivityTimer | [ms1] |
| drx-RetransmissionTimerDL | [sl1] |
| drx-RetransmissionTimerUL | [sl1] |
| longDRX-CycleStartOffset | [ms40] |
| shortDRX | disable |

**Table A.4.5.1.4.1-5: TimeAlignmentTimer -Configuration for in-sync testing**

| Field | | Test 1 |
|---|---|---|
| | | **Value** |
| TimeAlignmentTimer | | infinity |
| periodicityAndOffset in SchedulingRequestResourceConfig | Config 1, 2, 4, 5 | [sl5] |
| | Config 3, 6 | [sl10] |

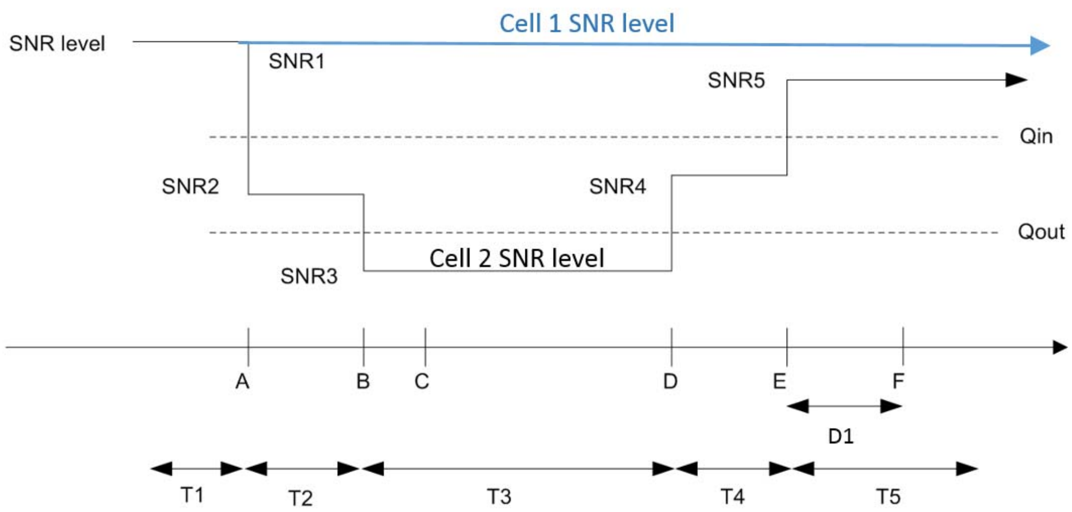


**Figure A.4.5.1.4.1-1: SNR variation for in-sync testing**

### A.4.5.1.4.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

#### A.4.5.1.5 EN-DC Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with CSI-RS-based RLM in non-DRX mode

##### A.4.5.1.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR1 PSCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.4.5.1.5.1-1, A.4.5.1.5.1-2, and A.4.5.1.5.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.4.5.1.5.1-1 shows the variation of the downlink SNR in the E-UTRAN PCell and the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] or [10] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test2.

**Table A.4.5.1.5.1-1: Supported test configurations for FR1 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.4.5.1.5.1-2: General test parameters for FR1 PSCell for CSI-RS out-of-sync testing in non-DRX mode**

| Parameter | | Unit | Value Test 1 | Value Test 2 |
|---|---|---|---|---|
| Active E-UTRA PCell | | | Cell 1 | Cell 1 |
| E-UTRA RF Channel Number | | | 1 | 1 |
| Active PSCell | | | Cell 2 | Cell 2 |
| RF Channel Number | | | 2 | 2 |
| Duplex mode | Config 1, 4 | | FDD | FDD |
| | Config 2, 3, 5, 6 | | TDD | TDD |
| TDD Configuration | Config 1, 4 | | Not Applicable | Not Applicable |
| | Config 2, 5 | | [TDDConf.1.1] | [TDDConf.1.1] |
| | Config 3, 6 | | [TDDConf.1.2] | [TDDConf.1.2] |
| CORESET Reference Channel | Config 1, 4 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] |
| | Config 2, 5 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] |
| | Config 3, 6 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] |
| SSB Configuration | Config 1, 4 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 2, 5 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 3, 6 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| SMTC Configuration | Config 1, 2, 4, 5 | | FR1 patterm 1 | FR1 patterm 1 |
| | Config 3, 6 | | FR1 patterm 2 | FR1 patterm 2 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2, 4, 5 | | 15 KHz | 15 KHz |
| | Config 3, 6 | | 30 KHz | 30 KHz |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *OFF* | *OFF* |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1, 2, 4, 5 | slot | [5] | [5] |
| | Config 3, 6 | | [10] | [10] |
| T1 | | s | 1 | 1 |
| T2 | | s | 0.4 | 0.4 |

| | | | |
|---|---|---|---|
| T3 | s | [0.6] | [0.6] |
| D1 | s | [0.24] | [0.44] |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts.<br>Note 2: E-UTRAN is in non-DRX mode under test. | | | |

**Table A.4.5.1.5.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in non-DRX mode**

| Parameter | | Unit | Test 1 | | | Test 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1, 4 | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2, 5 | | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3, 6 | | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1, 4 | dBm/15KHz | [-98] | | | [-98] | | |
| | Config 2, 5 | | [-98] | | | [-98] | | |
| | Config 3, 6 | | [-98] | | | [-98] | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | [TDL-C 300ns 100Hz] | | |
| Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.<br>Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.<br>Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.<br>Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.<br>Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.1.5.1-1.<br>Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6]. | | | | | | | | |

**Table A.4.5.1.5.1-3: Measurement gap configuration for FR1 CSI-RS out-of-sync radio link monitoring in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |
| Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap) | |

**Table A.4.5.1.5.1-4: NZP-CSI-RS resource configuration for FR1 CSI-RS out-of-sync radio link monitoring in non-DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation Note 1 | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.4.5.1.5.1-1 | | |

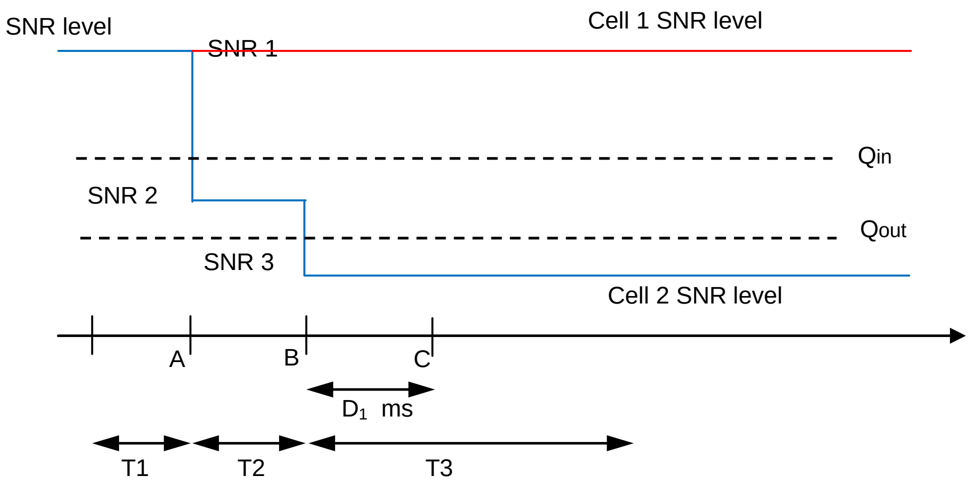


**Figure A.4.5.1.5.1-1: SNR variation for CSI-RS out-of-sync testing**

### A.4.5.1.5.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1 (E-UTRAN PCell).

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 (PSCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

The UE shall stop transmitting uplink signal in Cell 2 (PSCell) no later than time point C ($D_1$ = [TBD] ms after the start of the time duration T3) on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

## A.4.5.1.6 EN-DC Radio Link Monitoring In-sync Test for FR1 PSCell configured with CSI-RS-based RLM in non-DRX mode

### A.4.5.1.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR1 PSCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.4.5.1.6.1-1, A.4.5.1.6.1-2, A.4.5.1.6.1-3, A.4.5.1.6.1-4, A.4.5.1.6.1-5, and A.4.5.1.6.1-6 below. There are two cells, cell 1which is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.1.6.1-1 shows the variation of the downlink SNR in the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] or [10] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 4.

**Table A.4.5.1.6.1-1: Supported test configurations for FR1 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.4.5.1.6.1-2: General test parameters for FR1 PSCell for CSI-RS in-sync testing in non-DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 3 | Test 4 |
| Active E-UTRA PCell | | | Cell 1 | Cell 1 |
| E-UTRA RF Channel Number | | | 1 | 1 |
| Active PSCell | | | Cell 2 | Cell 2 |
| RF Channel Number | | | 2 | 2 |
| Duplex mode | Config 1, 4 | | FDD | FDD |
| | Config 2, 3, 5, 6 | | TDD | TDD |
| TDD Configuration | Config 1, 4 | | Not Applicable | Not Applicable |
| | Config 2, 5 | | [TDDConf.1.1] | [TDDConf.1.1] |
| | Config 3, 6 | | [TDDConf.1.2] | [TDDConf.1.2] |
| CORESET Reference Channel | Config 1, 4 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] |
| | Config 2, 5 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] |
| | Config 3, 6 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] |
| SSB Configuration | Config 1, 4 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 2, 5 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 3, 6 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| SMTC Configuration | Config 1, 2, 4, 5 | | FR1 patterm 1 | FR1 patterm 1 |
| | Config 3, 6 | | FR1 patterm 2 | FR1 patterm 2 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2, 4, 5 | | 15 KHz | 15 KHz |
| | Config 3, 6 | | 30 KHz | 30 KHz |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| In sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 4 | 4 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |

| | | | | |
|---|---|---|---|---|
| | REG bundle size | | 6 | 6 |
| DRX | | | *OFF* | *OFF* |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1, 2, 4, 5 | slot | [5] | [5] |
| | Config 3, 6 | | [10] | [10] |
| T1 | | s | 1 | 1 |
| T2 | | s | 0.4 | 0.4 |
| T3 | | s | [0.6] | [0.6] |
| D1 | | s | [0.24] | [0.44] |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts.<br>Note 2: E-UTRAN is in non-DRX mode under test. | | | | |

**Table A.4.5.1.6.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode**

| Parameter | | Unit | Test 3 | | | Test 4 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1, 4 | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2, 5 | | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3, 6 | | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1, 4 | dBm/15KHz | [-98] | | | [-98] | | |
| | Config 2, 5 | | [-98] | | | [-98] | | |
| | Config 3, 6 | | [-98] | | | [-98] | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | [TDL-C 300ns 100Hz] | | |

Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.1.6.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.4.5.1.6.1-3: Measurement gap configuration for FR1 CSI-RS in-sync radio link monitoring in non-DRX mode**

| Field | Test 4 |
|---|---|
| | Value |
| gapOffset | [0] |
| Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap) | |

**Table A.4.5.1.6.1-4: NZP-CSI-RS resource configuration for FR1 CSI-RS in-sync radio link monitoring in non-DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation Note 1 | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.4.5.1.6.1-1 | | |

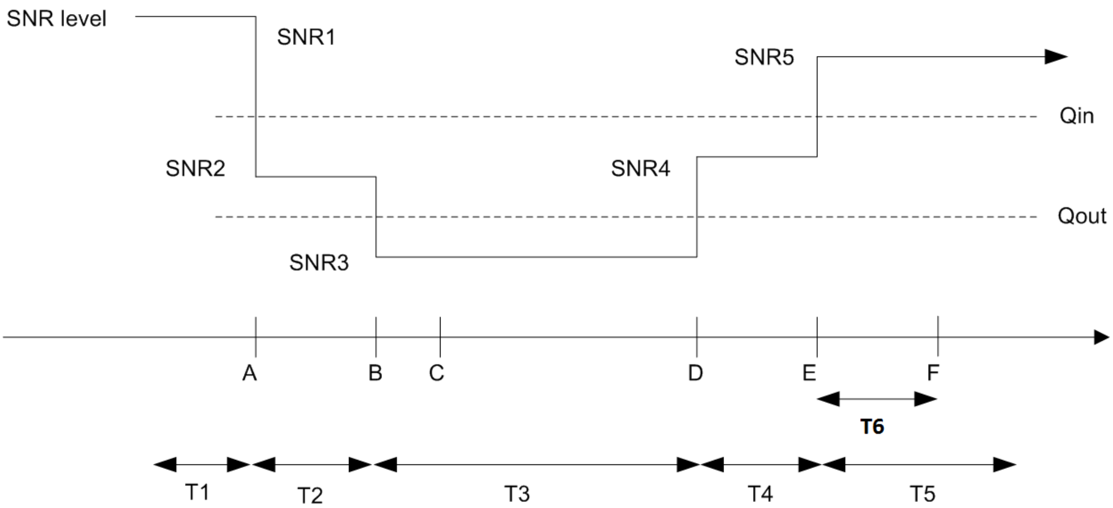


**Figure A.4.5.1.6.1-1: SNR variation for CSI-RS in-sync testing**

### A.4.5.1.6.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

#### A.4.5.1.7 EN-DC Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with CSI-RS-based RLM in DRX mode

##### A.4.5.1.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR1 PSCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.4.5.1.7.1-1, A.4.5.1.7.1-2, and A.4.5.1.7.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.4.5.1.7.1-1 shows the variation of the downlink SNR in the E-UTRAN PCell and the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] or [10] ms. In the test, DRX configuration is enabled in PSCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 6.

**Table A.4.5.1.7.1-1: Supported test configurations for FR1 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.4.5.1.7.1-2: General test parameters for FR1 PSCell for CSI-RS out-of-sync testing in DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 5 | Test 6 |
| Active E-UTRA PCell | | | Cell 1 | Cell 1 |
| E-UTRA RF Channel Number | | | 1 | 1 |
| Active PSCell | | | Cell 2 | Cell 2 |
| RF Channel Number | | | 2 | 2 |
| Duplex mode | Config 1, 4 | | FDD | FDD |
| | Config 2, 3, 5, 6 | | TDD | TDD |
| TDD Configuration | Config 1, 4 | | Not Applicable | Not Applicable |
| | Config 2, 5 | | [TDDConf.1.1] | [TDDConf.1.1] |
| | Config 3, 6 | | [TDDConf.1.2] | [TDDConf.1.2] |
| CORESET Reference Channel | Config 1, 4 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] |
| | Config 2, 5 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] |
| | Config 3, 6 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] |
| SSB Configuration | Config 1, 4 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 2, 5 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 3, 6 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| SMTC Configuration | Config 1, 2, 4, 5 | | FR1 patterm 1 | FR1 patterm 1 |
| | Config 3, 6 | | FR1 patterm 2 | FR1 patterm 2 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2, 4, 5 | | 15 KHz | 15 KHz |
| | Config 3, 6 | | 30 KHz | 30 KHz |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *640* | *640* |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1, 2, 4, 5 | slot | [5] | [5] |
| | Config 3, 6 | | [10] | [10] |
| T1 | | s | 1 | 1 |
| T2 | | s | 0.4 | 0.4 |

| | | | |
|---|---|---|---|
| T3 | s | [0.6] | [0.6] |
| D1 | s | [0.24] | [0.44] |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts.<br>Note 2: E-UTRAN is in non-DRX mode under test. | | | |

**Table A.4.5.1.7.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in DRX mode**

| Parameter | | Unit | Test 5 | | | Test 6 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1, 4 | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2, 5 | | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3, 6 | | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1, 4 | dBm/15KHz | [-98] | | | [-98] | | |
| | Config 2, 5 | | [-98] | | | [-98] | | |
| | Config 3, 6 | | [-98] | | | [-98] | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | [TDL-C 300ns 100Hz] | | |
| Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.<br>Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.<br>Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.<br>Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.<br>Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.1.7.1-1.<br>Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6]. | | | | | | | | |

**Table A.4.5.1.7.1-3: Measurement gap configuration for FR1 CSI-RS out-of-sync radio link monitoring in DRX mode**

| Field | Test 6 |
|---|---|
| | Value |
| gapOffset | [0] |
| Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap) | |

**Table A.4.5.1.7.1-4: NZP-CSI-RS resource configuration for FR1 CSI-RS out-of-sync radio link monitoring in DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation Note 1 | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.4.5.1.7.1-1 | | |

**Table A.4.5.1.7.1-5: DRX-Configuration for FR1 CSI-RS out-of-sync radio link monitoring in DRX mode.**

| Field | Test 5 | Test 6 |
|---|---|---|
| | Value | Value |
| drx-onDurationTimer | [ms6] | [ms6] |
| drx-InactivityTimer | [ms1] | [ms1] |
| drx-RetransmissionTimerDL | [sl1] | [sl1] |
| drx-RetransmissionTimerUL | [sl1] | [sl1] |
| longDRX-CycleStartOffset | [ms640] | [ms40] |
| shortDRX | disable | disable |

**Table A.4.5.1.7.1-6: TimeAlignmentTimer -Configuration for FR1 CSI-RS out-of-sync radio link monitoring in DRX mode.**

| Field | | Test 5 | Test 6 |
|---|---|---|---|
| | | Value | Value |
| TimeAlignmentTimer | | infinity | infinity |
| periodicityAndOffset in SchedulingRequestResourceConfig | Config 1, 2, 4, 5 | [sl5] | [sl5] |
| | Config 3, 6 | [sl10] | [sl10] |

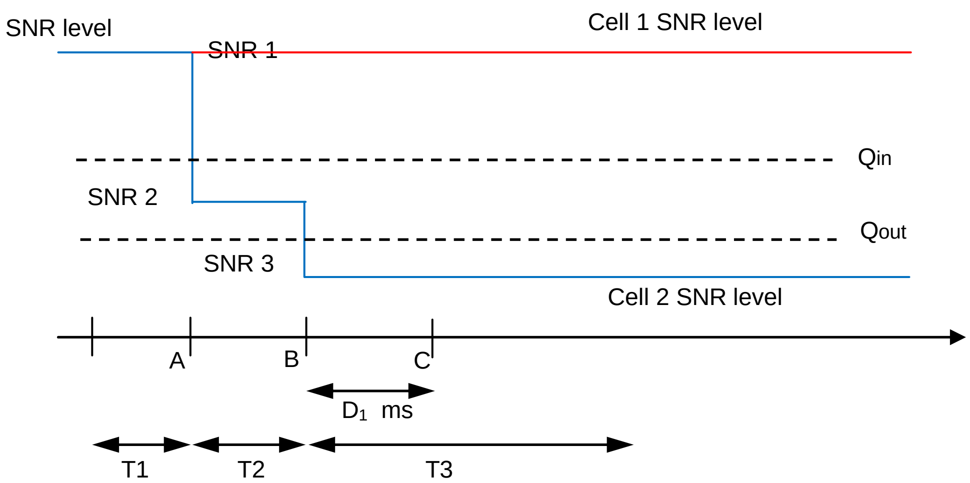


**Figure A.4.5.1.7.1-1: SNR variation for CSI-RS out-of-sync testing**

#### A.4.5.1.7.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1 (E-UTRAN PCell).

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 (PSCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

The UE shall stop transmitting uplink signal in Cell 2 (PSCell) no later than time point C ($D_1$ = [TBD] ms after the start of the time duration T3) on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

### A.4.5.1.8 EN-DC Radio Link Monitoring In-sync Test for FR1 PSCell configured with CSI-RS-based RLM in DRX mode

#### A.4.5.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR1 PSCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.4.5.1.8.1-1, A.4.5.1.81-2, A.4.5.1.8.1-3 and A.4.5.1.8.1-4 below. There are two cells, cell 1which is the E-UTRAN PCell, and cell 2 is the NR PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.1.8.1-1 shows the variation of the downlink SNR in the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] or [10] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 7.

**Table A.4.5.1.8.1-1: Supported test configurations for FR1 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.4.5.1.8.1-2: General test parameters for FR1 PSCell for CSI-RS in-sync testing in non-DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 7 | Test 8 |
| Active E-UTRA PCell | | | Cell 1 | Cell 1 |
| E-UTRA RF Channel Number | | | 1 | 1 |
| Active PSCell | | | Cell 2 | Cell 2 |
| RF Channel Number | | | 2 | 2 |
| Duplex mode | Config 1, 4 | | FDD | FDD |
| | Config 2, 3, 5, 6 | | TDD | TDD |
| TDD Configuration | Config 1, 4 | | Not Applicable | Not Applicable |
| | Config 2, 5 | | [TDDConf.1.1] | [TDDConf.1.1] |
| | Config 3, 6 | | [TDDConf.1.2] | [TDDConf.1.2] |
| CORESET Reference Channel | Config 1, 4 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] |
| | Config 2, 5 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] |
| | Config 3, 6 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] |
| SSB Configuration | Config 1, 4 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 2, 5 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 3, 6 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| SMTC Configuration | Config 1, 2, 4, 5 | | FR1 patterm 1 | FR1 patterm 1 |
| | Config 3, 6 | | FR1 patterm 2 | FR1 patterm 2 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2, 4, 5 | | 15 KHz | 15 KHz |
| | Config 3, 6 | | 30 KHz | 30 KHz |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| In sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 4 | 4 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |

| | | | | |
|---|---|---|---|---|
| | REG bundle size | | 6 | 6 |
| DRX | | | 640 | 640 |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1, 2, 4, 5 | slot | [5] | [5] |
| | Config 3, 6 | | [10] | [10] |
| T1 | | s | 1 | 1 |
| T2 | | s | 0.4 | 0.4 |
| T3 | | s | [0.6] | [0.6] |
| D1 | | s | [0.24] | [0.44] |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts.<br>Note 2: E-UTRAN is in non-DRX mode under test. | | | | |

**Table A.4.5.1.8.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode**

| Parameter | | Unit | Test 7 | | | Test 8 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1, 4 | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2, 5 | | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3, 6 | | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1, 4 | dBm/15KHz | [-98] | | | [-98] | | |
| | Config 2, 5 | | [-98] | | | [-98] | | |
| | Config 3, 6 | | [-98] | | | [-98] | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | [TDL-C 300ns 100Hz] | | |
| Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.<br>Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.<br>Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.<br>Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.<br>Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.1.8.1-1.<br>Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6]. | | | | | | | | |

**Table A.4.5.1.8.1-3: Measurement gap configuration for FR1 CSI-RS in-sync radio link monitoring in non-DRX mode**

| Field | Test 8 |
|---|---|
| | Value |
| gapOffset | [0] |
| Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap) | |

**Table A.4.5.1.8.1-4: NZP-CSI-RS resource configuration for FR1 CSI-RS in-sync radio link monitoring in non-DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation[Note 1] | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.4.5.1.8.1-1 | | |

**Table A.4.5.1.8.1-5: DRX-Configuration for FR1 CSI-RS in-sync radio link monitoring in DRX mode.**

| Field | Test 5 | Test 6 |
|---|---|---|
| | Value | Value |
| drx-onDurationTimer | [ms6] | [ms6] |
| drx-InactivityTimer | [ms1] | [ms1] |
| drx-RetransmissionTimerDL | [sl1] | [sl1] |
| drx-RetransmissionTimerUL | [sl1] | [sl1] |
| longDRX-CycleStartOffset | [ms640] | [ms40] |
| shortDRX | disable | disable |

**Table A.4.5.1.8.1-6: TimeAlignmentTimer -Configuration for FR1 CSI-RS in-sync radio link monitoring in DRX mode.**

| Field | | Test 5 | Test 6 |
|---|---|---|---|
| | | Value | Value |
| TimeAlignmentTimer | | infinity | infinity |
| periodicityAndOffset in SchedulingRequestResourceConfig | Config 1, 2, 4, 5 | [sl5] | [sl5] |
| | Config 3, 6 | [sl10] | [sl10] |

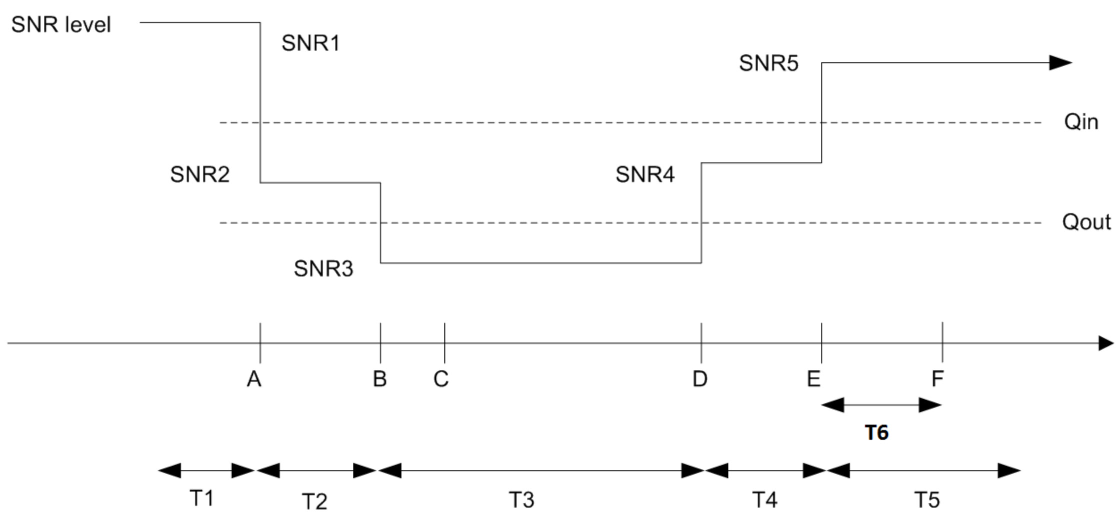


**Figure A.4.5.1.8.1-1: SNR variation for CSI-RS in-sync testing**

#### A.4.5.1.8.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

## A.4.5.2 Interruption

### A.4.5.2.1 E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

#### A.4.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that when LTE PCell is in DRX and NR PSCell is in non-DRX, NR PSCell interruptions due to transitions from active to non-active and from non-active to active during LTE PCell DRX the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in section 8. 2.1.2. Supported test configurations are shown in table A.4.5.2.1.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.4.5.2.1.1-2 and A.4.5.2.1.1-3. The E-UTRAN PCell DRX configuration parameters are given in Table A.4.5.2.1.1-4 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are two cells: Cell1 and Cell2. Cell1 is LTE PCell and Cell2 is NR FR1 PSCell . The test consists of one time period, with duration of T1. During T1, NR PSCell is continuously scheduled in DL while LTE PCell is not scheduled and has DRX configured. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell1 and Cell2. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. Prior to start of T1 the DRX inactivity timer for the LTE PCell has already expired. During T1 the UE shall be continuously scheduled on NR PSCell while not scheduled on LTE PCell. CORESET indicating a new transmission on PSCell shall be sent continuously during the whole time duration to ensure UE would not enter DRX state on PSCell.

**Table A.4.5.2.1.1-1: Interruption at transitions between active and non-active during DRX supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.4.5.2.1.1-2: General test parameters for E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in synchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF Channel Number | | 1, 2 | One is E-UTRAN RF channel and the other is NR RF channel |
| Active PCell | | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell | | Cell2 | PSCell on NR RF channel number 2. |
| CP length | | Normal | Applicable to cell1 and cell 2 |
| DRX | | ON | DRX related parameters are defined in Table A.4.5.2.1.1-3 |
| Measurement gap pattern Id | | OFF | |
| T1 | s | 10 | |

**Table A.4.5.2.1.1- 3: NR cell specific test parameters for E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in synchronous EN-DC**

| Parameter | | Unit | Cell 2 |
|---|---|---|---|
| Frequency Range | | | FR1 |
| Duplex mode | Config 1,4 | | FDD |
| | Config 2,3,5,6 | | TDD |
| TDD configuration | Config 1,4 | | Not Applicable |
| | Config 2,5 | | TDDConf.1.1 |
| | Config 3,6 | | TDDConf.2.1 |
| $BW_{channel}$ | Config 1,4 | | 10: $N_{RB,c}$ = 52 |
| | Config 2,5 | | 10: $N_{RB,c}$ = 52 |
| | Config 3,6 | | 40: $N_{RB,c}$ = 106 |
| Initial BWP Configuration | Config 1,4 | | DLBWP.0.2 Note5 |
| | Config 2,5 | | DLBWP.0.2 Note5 |
| | Config 3,6 | | DLBWP.0.2 Note5 |
| PDSCH Reference measurement channel | Config 1,4 | | SR.1.1 FDD |
| | Config 2,5 | | SR.1.1 TDD |
| | Config 3,6 | | SR2.1 TDD |
| RMSI CORESET parameters | Config 1,4 | | CR.1.1 FDD |
| | Config 2,5 | | CR.1.1 TDD |
| | Config 3,6 | | CR2.1 TDD |
| PDCCH CORESET parameters | Config 1,4 | | CCR.1.1 FDD |
| | Config 2,5 | | CCR.1.1 TDD |
| | Config 3,6 | | CCR.2.1 TDD |
| OCNG Patterns | | | OP.1 |
| SMTC Configuration | | | SMTC.1 |
| SSB Configuration | Config 1,2,4,5 | | SSB.1 FR1 |
| | Config 3,6 | | SSB.2 FR1 |
| Correlation Matrix and Antenna Configuration | | | 1x2 Low |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | |
| EPRE ratio of PDSCH to PDSCH | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| $N_{oc}$ Note 2 | | dBm/15 kHz | [-104] |
| SS-RSRP Note 3 | | dBm/15 kHz | [-87] |
| $\hat{E}_s/I_{ot}$ | | dB | 17 |
| $\hat{E}_s/N_{oc}$ | | dB | 17 |
| $N_{oc}$ Note 2 | Config 1,2,4,5 | dBm/SCS | [-104] |
| | Config 3,6 | | [-101] |
| Io Note3 | Config 1,2,4,5 | dBm/ 9.36MHz | [-59] |
| | Config 3,6 | dBm/ 38.16MHz | [-61.9] |
| Time offset to cell1 Note 4 | | µs | 33 |
| Propagation Condition | | | AWGN |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3 SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess.
Note 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells
Note 5: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2 defined in TS 38.213 [3] section 12.

**Table A.4.5.2.1.1- 4: E-UTRAN PCell DRX-Configuration for E-UTRAN - NR FR1 interruption at transitions between active and non-active during DRX in synchronous DC**

| Field | Cell1 | Comment |
|---|---|---|
| | Value | |
| onDurationTimer | psf1 | As specified in clause 6.3.2 in TS 36.331 |
| drx-InactivityTimer[Note 1] | psf1 | |
| drx-RetransmissionTimer | psf1 | |
| longDRX-CycleStartOffset | Sf160 | |
| shortDRX | disable | |
| Note 1: UE is continuously scheduled in NR PSCell | | |

### A.4.5.2.1.2 Test Requirements

The UE shall be continuously scheduled in NR PSCell during the entire length of T1. UE shall not be scheduled in LTE PCell during T1. During the time duration T1 the UE shall transmit at least 99% of ACK/NACK on NR PSCell.

Interruption on NR PSCell shall not exceed X as defined in Table A.4.5.2.1.2-1.

**Table A.4.5.2.1.2-1: Interruption length X at transition between active and non-active during DRX**

| $\mu$ | NR Slot length (ms) | Interruption length X |
|---|---|---|
| | | Sync |
| 0 | 1 | 1 |
| 1 | 0.5 | 1 |

The rate of correct events observed during repeated tests shall be at least 90%.

## A.4.5.2.2 E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

### A.4.5.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that when LTE PCell is in DRX and NR PSCell is in non-DRX, NR PSCell interruptions due to transitions from active to non-active and from non-active to active during LTE PCell DRX the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in section 8. 2.1.2. Supported test configurations are shown in table A.4.5.2.1.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.4.5.2.2.1-2 and A.4.5.2.2.1-3. The E-UTRAN PCell DRX configuration parameters are given in Table A.4.5.2.2.1-4 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are two cells: Cell1 and Cell2. Cell1 is LTE PCell and Cell2 is NR FR1 PSCell . The test consists of one time period, with duration of T1. During T1, NR PSCell is continuously scheduled in DL while LTE PCell is not scheduled and has DRX configured. Prior to the start of the time duration T1, Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. Prior to start of T1 the DRX inactivity timer for the LTE PCell has already expired. During T1 the UE shall be continuously scheduled on NR PSCell while not scheduled on LTE PCell. PDCCH indicating a new transmission on PSCell shall be sent continuously during the whole time duration to ensure UE would not enter DRX state on PSCell.

**Table A.4.5.2.1.1-1: Interruption at transitions between active and non-active during DRX supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.4.5.2.2.1-1: General test parameters for E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF Channel Number | | 1, 2 | One is E-UTRAN RF channel and the other is NR RF channel |
| Active PCell | | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell | | Cell2 | PSCell on NR RF channel number 2. |
| CP length | | Normal | Applicable to cell1 and cell 2 |
| DRX | | ON | DRX related parameters are defined in Table A.4.5.2.3.1-3 |
| Measurement gap pattern Id | | OFF | |
| T1 | s | 10 | |

Table A.4.5.2.2.1-2: NR cell specific test parameters for E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

| Parameter | | Unit | Cell 2 |
|---|---|---|---|
| Frequency Range | | | FR1 |
| Duplex mode | Config 1,4 | | FDD |
| | Config 2,3,5,6 | | TDD |
| TDD configuration | Config 1,4 | | Not Applicable |
| | Config 2,5 | | TDDConf.1.1 |
| | Config 3,6 | | TDDConf.2.1 |
| $BW_{channel}$ | Config 1,4 | | 10: $N_{RB,c}$ = 52 |
| | Config 2,5 | | 10: $N_{RB,c}$ = 52 |
| | Config 3,6 | | 40: $N_{RB,c}$ = 106 |
| Initial BWP Configuration | Config 1,4 | | DLBWP.0.2$^{Note5}$ |
| | Config 2,5 | | DLBWP.0.2$^{Note5}$ |
| | Config 3,6 | | DLBWP.0.2$^{Note5}$ |
| PDSCH Reference measurement channel | Config 1,4 | | SR.1.1 FDD |
| | Config 2,5 | | SR.1.1 TDD |
| | Config 3,6 | | SR2.1 TDD |
| RMSI CORESET parameters | Config 1,4 | | CR.1.1 FDD |
| | Config 2,5 | | CR.1.1 TDD |
| | Config 3,6 | | CR2.1 TDD |
| PDCCH CORESET parameters | Config 1,4 | | CCR.1.1 FDD |
| | Config 2,5 | | CCR.1.1 TDD |
| | Config 3,6 | | CCR.2.1 TDD |
| OCNG Patterns | | | OP.1 |
| SMTC Configuration | | | SMTC.1 |
| SSB Configuration | Config 1,2,4,5 | | SSB.1 FR1 |
| | Config 3,6 | | SSB.2 FR1 |
| Correlation Matrix and Antenna Configuration | | | 1x2 Low |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | |
| EPRE ratio of PDSCH to PDSCH | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| $N_{oc}$ $^{Note 2}$ | | dBm/15 kHz | [-104] |
| SS-RSRP $^{Note 3}$ | | dBm/15 kHz | [-87] |
| $\hat{E}_s/I_{ot}$ | | dB | 17 |
| $\hat{E}_s/N_{oc}$ | | dB | 17 |
| $N_{oc}$ $^{Note 2}$ | Config 1,2,4,5 | dBm/SCS | [-104] |
| | Config 3,6 | | [-101] |
| Io$^{Note3}$ | Config 1,2,4,5 | dBm/ 9.36MHz | [-59] |
| | Config 3,6 | dBm/ 38.16MHz | [-61.9] |
| Time offset to cell1 $^{Note 4}$ | | µs | 500 |
| Propagation Condition | | | AWGN |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess.
Note 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells
Note 5: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2 defined in TS 38.213 [3] section 12.

**Table A.4.5.2.2.1-3: E-UTRAN PCell DRX-Configuration for E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC**

| Field | Cell1 | Comment |
|---|---|---|
| | Value | |
| onDurationTimer | psf1 | As specified in clause 6.3.2 in TS 36.331 |
| drx-InactivityTimer[Note 1] | psf1 | |
| drx-RetransmissionTimer | psf1 | |
| longDRX-CycleStartOffset | Sf320 | |
| shortDRX | disable | |
| Note 1: UE is continuously scheduled in NR PSCell | | |

### A.4.5.2.2.2 Test Requirements

The UE shall be continuously scheduled in NR PSCell during the entire length of T1. UE shall not be scheduled in LTE PCell during T1. During the time duration T1 the UE shall transmit at least 99% of ACK/NACK on NR PSCell.

Interruption on NR PSCell shall not exceed X as defined in Table A.4.5.2.2.2-1.

**Table A.4.5.2.2.2-1: Interruption length X at transition between active and non-active during DRX**

| $\mu$ | NR Slot length (ms) | Interruption length X |
|---|---|---|
| | | Async |
| 0 | 1 | 2 |
| 1 | 0.5 | 2 |

The rate of correct events observed during repeated tests shall be at least 90%.

## A.4.5.2.3 E-UTRAN – NR FR1 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

### A.4.5.2.3.1 Test Purpose and Environment

The purpose of this test is to verify NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in section 8. 2.1.2. Supported test configurations are shown in table A.4.5.2.3.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.4.5.2.3.1-2 and A.4.5.2.3.1-3 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are three cells: Cell1 Cell2 and Cell3. Cell1 is LTE PCell, Cell2 and Cell 3 is NR PSCell and NR deactivated SCell. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received at the UE antenna connector, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

**Table A.4.5.2.3.1-1: Interruptions during measurements on deactivated NR SCC supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.4.5.2.3.1-2: General test parameters for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in synchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF Channel Number | | 1, 2 | One is E-UTRAN RF channel and the other two are NR RF channel |
| Active PCell | | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Active PSCell | | Cell2 | PSCell on NR RF channel number 2. |
| Configured deactivated SCell | | Cell3 | Deactivated SCell on NR RF channel number 2. |
| CP length | | Normal | Applicable to cell1, cell 2 and cell3 |
| DRX | | OFF | |
| Measurement gap pattern Id | | OFF | |
| SCell measurement cycle (measCycleSCell) | ms | 640 | |
| T1 | s | 10 | |

**Table A.4.5.2.3.1-3: NR cell specific test parameters for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in synchronous EN-DC**

| Parameter | | Unit | Cell 2 | Cell 3 |
|---|---|---|---|---|
| Frequency Range | | | FR1 | FR1 |
| Duplex mode | Config 1,4 | | FDD | FDD |
| | Config 2,3,5,6 | | TDD | TDD |
| TDD configuration | Config 1,4 | | Not Applicable | Not Applicable |
| | Config 2,5 | | TDDConf.1.1 | TDDConf.1.1 |
| | Config 3,6 | | TDDConf.2.1 | TDDConf.2.1 |
| $BW_{channel}$ | Config 1,4 | | 10: $N_{RB,c}$ = 52 | 10: $N_{RB,c}$ = 52 |
| | Config 2,5 | | 10: $N_{RB,c}$ = 52 | 10: $N_{RB,c}$ = 52 |
| | Config 3,6 | | 40: $N_{RB,c}$ = 106 | 40: $N_{RB,c}$ = 106 |
| Initial BWP Configuration | Config 1,4 | | DLBWP.0.2 Note6 | DLBWP.0.2 Note6 |
| | Config 2,5 | | DLBWP.0.2 Note6 | DLBWP.0.2 Note6 |
| | Config 3,6 | | DLBWP.0.2 Note6 | DLBWP.0.2 Note6 |
| PDSCH Reference measurement channel | Config 1,4 | | SR.1.1 FDD | - |
| | Config 2,5 | | SR.1.1 TDD | - |
| | Config 3,6 | | SR2.1 TDD | - |
| RMSI CORESET parameters | Config 1,4 | | CR.1.1 FDD | CR.1.1 FDD |
| | Config 2,5 | | CR.1.1 TDD | CR.1.1 TDD |
| | Config 3,6 | | CR2.1 TDD | CR2.1 TDD |
| PDCCH CORESET parameters | Config 1,4 | | CCR.1.1 FDD | CCR.1.1 FDD |
| | Config 2,5 | | CCR.1.1 TDD | CCR.1.1 TDD |
| | Config 3,6 | | CCR.2.1 TDD | CCR.2.1 TDD |
| OCNG Patterns | | | OP.1 | OP.1 |
| SMTC Configuration | | | SMTC.1 | SMTC.1 |
| SSB Configuration | Config 1,2,4,5 | | SSB.1 FR1 | SSB.1 FR1 |
| | Config 3,6 | | SSB.2 FR1 | SSB.2 FR1 |
| Correlation Matrix and Antenna Configuration | | | 1x2 Low | 1x2 Low |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | |
| $N_{oc}$ Note 2 | | dBm/15 kHz | [-104] | [-104] |
| SS-RSRP Note 3 | | dBm/15 kHz | [-87] | [-87] |
| $\hat{E}_s/I_{ot}$ | | dB | 17 | 17 |
| $\hat{E}_s/N_{oc}$ | | dB | 17 | 17 |
| $N_{oc}$ Note 2 | Config 1,2,4,5 | dBm/S | [-104] | [-104] |
| | Config 3,6 | | [-101] | [-101] |
| Io Note3 | Config 1,2,4,5 | dBm/ 9.36MHz | [-59] | [-59] |
| | Config 3,6 | dBm/ 38.16MHz | [-61.9] | [-61.9] |
| Time offset to cell1 Note 4 | | µs | 33 | 33 |
| Time offset to cell2 Note 5 | | µs | - | 3 |
| Propagation Condition | | | AWGN | AWGN |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.

Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess.

Note 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells

Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

Note 6: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2 defined in TS 38.213 [3] section 12.

#### A.4.5.2.3.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table A.4.5.2.3.2-1 if the NR PSCell is not in the same band as the deactivated SCell or Table A.4.5.2.3.2-2 if the NR PSCell is in the same band as the deactivated SCell.

**Table A.4.5.2.3.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell**

| $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 0 | 1 | 1 |
| 1 | 0.5 | 1 |

**Table A.4.5.2.3.2-2: Interruption duration if the NR PSCell is in the same band as the deactivated SCell**

| $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 0 | 1 | 1 + SMTC duration |
| 1 | 0.5 | 2 + SMTC duration |

The rate of correct events observed during repeated tests shall be at least 90%.

### A.4.5.2.4 E-UTRAN – NR FR1 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

#### A.4.5.2.4.1 Test Purpose and Environment

The purpose of this test is to verify NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in section 8. 2.1. Supported test configurations are shown in table A.4.5.2.4.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.4.5.2.4.1-2 and A.4.5.2.4.1-3 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are three cells: Cell1 Cell2 and Cell3. Cell1 is LTE PCell, Cell2 and Cell 3 is NR PSCell and NR deactivated SCell. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received at the UE antenna connector, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

**Table A.4.5.2.4.1-1: Interruptions during measurements on deactivated NR SCC supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.4.5.2.4.1-2: General test parameters for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in asynchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF Channel Number | | 1, 2 | One is E-UTRAN RF channel and the other two are NR RF channel |
| Active PCell | | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell | | Cell2 | PSCell on NR RF channel number 2. |
| Configured deactivated SCell | | Cell3 | Deactivated SCell on NR RF channel number 2. |
| CP length | | Normal | Applicable to cell1, cell 2 and cell3 |
| DRX | | OFF | |
| Measurement gap pattern Id | | OFF | |
| SCell measurement cycle (measCycleSCell) | ms | 640 | |
| T1 | s | 10 | |

**Table A.4.5.2.4.1-3: NR cell specific test parameters for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in asynchronous EN-DC**

| Parameter | | Unit | Cell 2 | Cell 3 |
|---|---|---|---|---|
| Frequency Range | | | FR1 | FR1 |
| Duplex mode | Config 1,4 | | FDD | FDD |
| | Config 2,3,5,6 | | TDD | TDD |
| TDD configuration | Config 1,4 | | Not Applicable | Not Applicable |
| | Config 2,5 | | TDDConf.1.1 | TDDConf.1.1 |
| | Config 3,6 | | TDDConf.2.1 | TDDConf.2.1 |
| $BW_{channel}$ | Config 1,4 | | 10: $N_{RB,c}$ = 52 | 10: $N_{RB,c}$ = 52 |
| | Config 2,5 | | 10: $N_{RB,c}$ = 52 | 10: $N_{RB,c}$ = 52 |
| | Config 3,6 | | 40: $N_{RB,c}$ = 106 | 40: $N_{RB,c}$ = 106 |
| Initial BWP Configuration | Config 1,4 | | DLBWP.0.2 Note6 | DLBWP.0.2 Note6 |
| | Config 2,5 | | DLBWP.0.2 Note6 | DLBWP.0.2 Note6 |
| | Config 3,6 | | DLBWP.0.2 Note6 | DLBWP.0.2 Note6 |
| PDSCH Reference measurement channel | Config 1,4 | | SR.1.1 FDD | - |
| | Config 2,5 | | SR.1.1 TDD | - |
| | Config 3,6 | | SR2.1 TDD | - |
| RMSI CORESET parameters | Config 1,4 | | CR.1.1 FDD | CR.1.1 FDD |
| | Config 2,5 | | CR.1.1 TDD | CR.1.1 TDD |
| | Config 3,6 | | CR2.1 TDD | CR2.1 TDD |
| RMC CORESET parameters | Config 1,4 | | CCR.1.1 FDD | CCR.1.1 FDD |
| | Config 2,5 | | CCR.1.1 TDD | CCR.1.1 TDD |
| | Config 3,6 | | CCR.2.1 TDD | CCR.2.1 TDD |
| OCNG Patterns | | | OP.1 | OP.1 |
| SSB Configuration | Config 1,2,4,5 | | SSB.1 FR1 | SSB.1 FR1 |
| | Config 3,6 | | SSB.2 FR1 | SSB.2 FR1 |
| SMTC Configuration | | | SMTC.1 | SMTC.1 |
| Correlation Matrix and Antenna Configuration | | | 1x2 Low | 1x2 Low |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | |
| $N_{oc}$ Note 2 | | dBm/15 kHz | [-104] | [-104] |
| SS-RSRP Note 3 | | dBm/15 kHz | [-87] | [-87] |
| $\hat{E}_s/I_{ot}$ | | dB | 17 | 17 |
| $\hat{E}_s/N_{oc}$ | | dB | 17 | 17 |
| $N_{oc}$ Note 2 | Config 1,2,4,5 | dBm/SCS | [-104] | [-104] |
| | Config 3,6 | | [-101] | [-101] |
| Io Note3 | Config 1,2,4,5 | dBm/ 9.36MHz | [-59] | [-59] |
| | Config 3,6 | dBm/ 38.16MHz | [-61.9] | [-61.9] |
| Time offset to cell1 Note 4 | | ms | 3 | 3 |
| Time offset to cell2 Note 5 | | µs | - | 3 |
| Propagation Condition | | | AWGN | AWGN |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess.
Note 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells
Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.
Note 6: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2 defined in TS 38.213 [3] section 12.

#### A.4.5.2.4.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table A.4.5.2.4.2-1 and Table A.4.5.2.4.2-2.

**Table A.4.5.2.4.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell**

| $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 0 | 1 | 1 |
| 1 | 0.5 | 1 |

**Table A.4.5.2.4.2-2: Interruption duration if the NR PSCell is in the same band as the deactivated SCell**

| $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 0 | 1 | 1 + SMTC duration |
| 1 | 0.5 | 2 + SMTC duration |

The rate of correct events observed during repeated tests shall be at least 90%.

### A.4.5.2.5 E-UTRAN – NR FR1 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

#### A.4.5.2.5.1 Test Purpose and Environment

The purpose of this test is to verify NR PSCell interruptions during the measurement on the deactivated E-UTRAN SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in section 8. 2.1.2. Supported test configurations are shown in table A.4.5.2.5.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.4.5.2.5.1-2 and A.4.5.2.5.1-3 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are three cells: Cell1, Cell2 and Cell3. Cell1 and Cell3 is E-UTRAN PCell and E-UTRAN deactivated SCell, Cell2 is NR FR1 PSCell. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated E-UTRAN SCells is received at the UE antenna connector, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

**Table A.4.5.2.5.1-1: Interruptions during measurements on deactivated E-UTRAN SCC supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.4.5.2.5.1-1: General test parameters for E-UTRAN – NR interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF Channel Number | | 1, 2 | One is E-UTRAN RF channel and the other two are NR RF channel |
| Active PCell | | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Active PSCell | | Cell2 | PSCell on NR RF channel number 2. |
| Configured deactivated SCell | | Cell3 | Deactivated SCell on NR RF channel number 2. |
| CP length | | Normal | Applicable to cell1, cell 2 and cell3 |
| DRX | | OFF | |
| Measurement gap pattern Id | | OFF | |
| SCell measurement cycle (measCycleSCell) | ms | 640 | |
| T1 | s | 10 | |

**Table A.4.5.2.5.1-2: NR cell specific test parameters for E-UTRAN – NR interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC**

| Parameter | | Unit | Cell 2 |
|---|---|---|---|
| Frequency Range | | | FR1 |
| Duplex mode | Config 1,4 | | FDD |
| | Config 2,3,5,6 | | TDD |
| TDD configuration | Config 1,4 | | Not Applicable |
| | Config 2,5 | | TDDConf.1.1 |
| | Config 3,6 | | TDDConf.2.1 |
| $BW_{channel}$ | Config 1,4 | MHz | 10: $N_{RB,c}$ = 52 |
| | Config 2,5 | | 10: $N_{RB,c}$ = 52 |
| | Config 3,6 | | 40: $N_{RB,c}$ = 106 |
| Initial BWP Configuration | Config 1,4 | | DLBWP.0.2 Note5 |
| | Config 2,5 | | DLBWP.0.2 Note5 |
| | Config 3,6 | | DLBWP.0.2 Note5 |
| PDSCH Reference measurement channel | Config 1,4 | | SR.1.1 FDD |
| | Config 2,5 | | SR.1.1 TDD |
| | Config 3,6 | | SR2.1 TDD |
| RMSI CORESET parameters | Config 1,4 | | CR.1.1 FDD |
| | Config 2,5 | | CR.1.1 TDD |
| | Config 3,6 | | CR2.1 TDD |
| RMC CORESET parameters | Config 1,4 | | CCR.1.1 FDD |
| | Config 2,5 | | CCR.1.1 TDD |
| | Config 3,6 | | CCR.2.1 TDD |
| OCNG Patterns | | | OP.1 |
| SMTC Configuration | | | SMTC.1 |
| SSB Configuration | Config 1,2,4,5 | | SSB.1 FR1 |
| | Config 3,6 | | SSB.2 FR1 |
| Correlation Matrix and Antenna Configuration | | | 1x2 Low |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | |
| EPRE ratio of PDSCH to PDSCH | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| $N_{oc}$ Note 2 | | dBm/15 kHz | [-104] |
| SS-RSRP Note 3 | | dBm/15 kHz | [-87] |
| $\hat{E}_s/I_{ot}$ | | dB | 17 |
| $\hat{E}_s/N_{oc}$ | | dB | 17 |
| $N_{oc}$ Note 2 | Config 1,2,4,5 | dBm/SCS | [-104] |
| | Config 3,6 | | [-101] |
| Io Note3 | Config 1,2,4,5 | dBm/ 9.36MHz | [-59] |
| | Config 3,6 | dBm/ 38.16MHz | [-61.9] |
| Time offset to cell1 Note 4 | | μs | 33 |
| Propagation Condition | | | AWGN |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess.
Note 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells
Note 5: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2 defined in TS 38.213 [3] section 12.

#### A.4.5.2.5.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed X defined in Table A.4.5.2.5.2-1 if the NR PSCell is not in the same band as the E-UTRAN deactivated SCell or Y in Table A.4.5.2.3.2-1 if the NR PSCell is in the same band as the E-UTRAN deactivated SCell.

**Table A.4.5.2.5.2-1: Interruption length X and Y at measurements on deactivated E-UTRA SCC**

| $\mu$ | NR Slot length (ms) | Interruption length X slot | Interruption length Y slot |
|---|---|---|---|
| | | Sync | |
| 0 | 1 | 1 | 1 |
| 1 | 0.5 | 1 | 1 |

The rate of correct events observed during repeated tests shall be at least 90%.

### A.4.5.2.6 E-UTRAN – NR FR1 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

#### A.4.5.2.6.1 Test Purpose and Environment

The purpose of this test is to verify E-UTRAN PCell and NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for E-UTRAN PCell and NR PSCell in EN-DC specified in section 8. 2.1. Supported test configurations are shown in table A.4.5.2.6.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.4.5.2.6.1-1 and A.4.5.2.6.1-2 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are three cells: Cell1 Cell2 and Cell3. Cell1 and Cell3 is E-UTRAN PCell and E-UTRAN deactivated SCell, Cell2 is NR FR1 PSCell. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received at the UE antenna connector, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

**Table A.4.5.2.6.1-1: Interruptions during measurements on deactivated E-UTRAN SCC supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.4.5.2.6.1-2: General test parameters for E-UTRAN – NR interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF Channel Number | | 1, 2 | One is E-UTRAN RF channel and the other two are NR RF channel |
| Active PCell | | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell | | Cell2 | PSCell on NR RF channel number 2. |
| Configured deactivated SCell | | Cell3 | Deactivated SCell on NR RF channel number 2. |
| CP length | | Normal | Applicable to cell1, cell 2 and cell3 |
| DRX | | OFF | |
| Measurement gap pattern Id | | OFF | |
| SCell measurement cycle (measCycleSCell) | ms | 640 | |
| T1 | s | 10 | |

**Table A.4.5.2.6.1-3: NR cell specific test parameters for E-UTRAN – NR interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC**

| Parameter | | Unit | Cell 2 |
|---|---|---|---|
| Frequency Range | | | FR1 |
| Duplex mode | Config 1,4 | | FDD |
| | Config 2,3,5,6 | | TDD |
| TDD configuration | Config 1,4 | | Not Applicable |
| | Config 2,5 | | TDDConf.1.1 |
| | Config 3,6 | | TDDConf.2.1 |
| $BW_{channel}$ | Config 1,4 | | 10: $N_{RB,c}$ = 52 |
| | Config 2,5 | | 10: $N_{RB,c}$ = 52 |
| | Config 3,6 | | 40: $N_{RB,c}$ = 106 |
| Initial BWP Configuration | Config 1,4 | | DLBWP.0.2[Note5] |
| | Config 2,5 | | DLBWP.0.2[Note5] |
| | Config 3,6 | | DLBWP.0.2[Note5] |
| PDSCH Reference measurement channel | Config 1,4 | | SR.1.1 FDD |
| | Config 2,5 | | SR.1.1 TDD |
| | Config 3,6 | | SR2.1 TDD |
| RMSI CORESET parameters | Config 1,4 | | CR.1.1 FDD |
| | Config 2,5 | | CR.1.1 TDD |
| | Config 3,6 | | CR2.1 TDD |
| RMC CORESET parameters | Config 1,4 | | CCR.1.1 FDD |
| | Config 2,5 | | CCR.1.1 TDD |
| | Config 3,6 | | CCR.2.1 TDD |
| OCNG Patterns | | | OP.1 |
| SMTC Configuration | | | SMTC.1 |
| SSB Configuration | Config 1,2,4,5 | | SSB.1 FR1 |
| | Config 3,6 | | SSB.2 FR1 |
| Correlation Matrix and Antenna Configuration | | | 1x2 Low |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | |
| EPRE ratio of PDSCH to PDSCH | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| $N_{oc}$ Note 2 | | dBm/15 kHz | [-104] |
| SS-RSRP Note 3 | | dBm/15 kHz | [-87] |
| $\hat{E}_s/I_{ot}$ | | dB | 17 |
| $\hat{E}_s/N_{oc}$ | | dB | 17 |
| $N_{oc}$ Note 2 | Config 1,2,4,5 | dBm/SCS | [-104] |
| | Config 3,6 | | [-101] |
| Io Note3 | Config 1,2,4,5 | dBm/ 9.36MHz | [-59] |
| | Config 3,6 | dBm/ 38.16MHz | [-61.9] |
| Time offset to cell1 Note 4 | | µs | 500 |
| Propagation Condition | | | AWGN |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess.
Note 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells
Note 5: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2 defined in TS 38.213 [3] section 12.

#### A.4.5.2.6.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on E-UTRAN PCell and NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on E-UTRAN PCell and NR PSCell shall not exceed the value defined in Table A.4.5.2.4.2-1 and Table A.4.5.2.4.2-2.

**Table A.4.5.2.6.2-1: Interruption duration if the NR PSCell is not in the same band as the E-UTRAN deactivated SCell**

| $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 0 | 1 | 1 |
| 1 | 0.5 | 1 |

**Table A.4.5.2.6.2-2: Interruption duration if the NR PSCell is in the same band as the E-UTRAN deactivated SCell**

| $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 0 | 1 | 1 + SMTC duration |
| 1 | 0.5 | 2 + SMTC duration |

The rate of correct events observed during repeated tests shall be at least 90%.

### A.4.5.2.7 E-UTRA – NR FR1 interruptions at UL carrier RRC reconfiguration for NR SCell

#### A.4.5.2.7.1 Test Purpose and Environment

The purpose of this test is to verify that when a supplementary UL carrier or a UL carrier is configured or released on a SCell, the interruption on the PSCell does not exceed the limits.The test will verify the interruption requirements during SUL carrier reconfiguration in clause 8.2.1.2.6.

There are three cells: E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and FR1 SCell (Cell3). PSCell is continuously scheduled in downlink and uplink during the whole test duration. The test parameters for PSCell and NR Scell are given in Table A.4.5.2.7.1-1, Table A.4.5.2.7.1-2, Table A.4.5.2.7.1-3 and Table A.4.5.2.7.1-4 below and the test parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. The test consists two tests. In test 1, the test consists of three time periods, with duration of T1, T2 and T3 respectively. During time duration T1 there is a NR uplink carrier on cell3. During time duration T2, a supplementary UL carrier is configured for SCell through *RRCReconfiguration*. During time duration T3, the supplementary UL carrier is released through *RRCReconfiguration*.

In test 2, the test consists of three time periods, with duration of T1, T2 and T3 respectively. Duringtime duration T1 there is a supplementray NR uplink carrier on cell3. During time duration T2, a NR UL carrier is configured for SCell through *RRCReconfiguration*. During time duration T3, the NR UL carrier is released through *RRCReconfiguration*.

**Table A.4.5.2.7.1-1: Supported test configurations**

| Configuration | PSCell (Cell2) | SCell (Cell3) |
|---|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex for DL, SUL duplex mode for UL |
| 2 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex for DL, SUL duplex mode for UL |
| 3 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex for DL, SUL duplex mode for UL |
| 4 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | 30kHz SSB SCS, 40MHz bandwidth, TDD duplex for DL, SUL duplex mode for UL |
| 5 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 30kHz SSB SCS, 40MHz bandwidth, TDD duplex for DL, SUL duplex mode for UL |
| 6 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | 30kHz SSB SCS, 40MHz bandwidth, TDD duplex for DL, SUL duplex mode for UL |
| 7 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex for DL, SUL duplex mode for UL |
| 8 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex for DL, SUL duplex mode for UL |
| 9 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex for DL, SUL duplex mode for UL |
| 10 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | 30kHz SSB SCS, 40MHz bandwidth, FDD duplex for DL, SUL duplex mode for UL |
| 11 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 30kHz SSB SCS, 40MHz bandwidth, FDD duplex for DL, SUL duplex mode for UL |
| 12 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | 30kHz SSB SCS, 40MHz bandwidth, FDD duplex for DL, SUL duplex mode for UL |
| Note: The UE is only required to be tested in one of the supported test configurations | | |

**Table A.4.5.2.7.1-2: General test parameters for EN-DC interruptions at UL carrier RRC reconfiguration for NR SCell**

| Parameter | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|
| RF Channel Number | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | 1, 2,3 | Three radio channels are used for these three tests. |
| Active cell | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and FR1 SCell (Cell3) | E-UTRAN PCell on RF channel number 1,<br>FR1 PSCell on RF channel number 2; FR1 SCell on RF channel number 3. |
| CP length | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | Normal | |
| DRX | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | OFF | |
| Measurement gap pattern Id | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | OFF | |
| SSB parameters | | | TBD | |
| SMTC parameters | | | TBD | |
| Filter coefficient | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | 0 | L3 filtering is not used |
| T1 | s | Config 1,2,3,4,5,6,7,8,9,10,11,12 | 5 | |
| T2 | s | Config 1,2,3,4,5,6,7,8,9,10,11,12 | 5 | |
| T3 | s | Config 1,2,3,4,5,6,7,8,9,10,11,12 | 5 | |

**Table A.4.5.2.7.1 -3: NR Cell specific test parameters for EN-DC interruptions at UL carrier RRC reconfiguration for cell2**

| Parameter | Unit | Test configuration | Test 1 | | | Test 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency Range | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | FR1 | | | FR1 | | |
| PUSCH parameters | | Config 1,2,3,4,5,6,7,8,9,10,11,12,7,8,9,10,11,12 | [TBD] | | | [TBD] | | |
| PUCCH parameters | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | [TBD] | | | [TBD] | | |
| PDSCH parameters defined in A.3.1.1 | | Config 1,4,7,10 | SR.1.1 FDD | | | SR.1.1 FDD | | |
| | | Config 2,5,8,11 | SR.1.1 TDD | | | SR.1.1 TDD | | |
| | | Config 3,6,9,12 | SR2.1 TDD | | | SR2.1 TDD | | |
| CORESET parameters defined in A.3.1.3 | | Config 1,4,7,10 | CCR.1.1 FDD | | | CCR.1.1 FDD | | |
| | | Config 2,5,8,11 | CCR.1.1 TDD | | | CCR.1.1 TDD | | |
| | | Config 3,6,9,12 | CCR2.1 TDD | | | CCR2.1 TDD | | |
| EPRE ratio of PSS to SSS | dB | Config 1,2,3,4,5,6,7,8,9,10,11,12 | 0 | | | | | |
| EPRE ratio of PBCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | | | | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | | | | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS | | | | | | | | |
| OCNG Patterns | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | OP.1 | | | OP.1 | | |
| $N_{oc}$ Note 2 | dBm/15 KHz | Config 1,2,3,4,5,6,7,8,9,10,11,12 | -102 | | | | | |
| $N_{oc}$ Note 2 | dBm/SCS | Config 1,2,4,5,7,8,10,11 | -102 | | | | | |
| | | Config 3,6,9,12 | -97 | | | | | |
| SS-RSRP Note 3 | dBm/SCS | Config 1,2,4,5,7,8,10,11 | -86 | -86 | -86 | -86 | -86 | -86 |
| | | Config 3,6,9,12 | -83 | -83 | -83 | -83 | -83 | -83 |
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2,3,4,5,6,7,8,9,10,11,12 | 16 | 16 | 16 | 16 | 16 | 16 |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2,3,4,5,6,7,8,9,10,11,12 | 16 | 16 | 16 | 16 | 16 | 16 |
| Io Note3 | dBm/9.36MHz | Config 1,2,4,5,7,8,10,11 | -57.9 | -57.9 | -57.9 | -57.9 | -57.9 | -57.9 |
| | dBm/38.16MHz | Config 3,6,9,12 | -51.8 | -51.8 | -51.8 | -51.8 | -51.8 | -51.8 |
| Propagation Condition | | | AWGN | | | | | |

| |
|---|
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |

**Table A.4.5.2.7.1 -4: NR Cell specific test parameters for EN-DC interruptions at UL carrier RRC reconfiguration for cell3**

| Parameter | Unit | Test configuration | Test 1 | | | Test 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |

| Frequency Range | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | FR1 | | | FR1 | | |
|---|---|---|---|---|---|---|---|---|
| PUSCH parameters on NR UL carrier | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | [TBD] | [TBD] | [TBD] | [TBD] | [TBD] | [TBD] |
| PUCCH parameters on NR UL carrier | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | [TBD] | [TBD] | [TBD] | [TBD] | [TBD] | [TBD] |
| PUSCH parameters on supplementary UL carrier | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | [TBD] | [TBD] | [TBD] | [TBD] | [TBD] | [TBD] |
| PUCCH parameters on supplementary UL carrier | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | [TBD] | [TBD] | [TBD] | [TBD] | [TBD] | [TBD] |
| PDSCH parameters defined in A.3.1.1 | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | [TBD] | [TBD] | [TBD] | [TBD] | [TBD] | [TBD] |
| CORESET parameters defined in A.3.1.3 | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | [TBD] | [TBD] | [TBD] | [TBD] | [TBD] | [TBD] |
| EPRE ratio of PSS to SSS | dB | Config 1,2,3,4,5,6,7,8,9,10,11,12 | 0 | | | | | |
| EPRE ratio of PBCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | | | | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | | | | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS | | | | | | | | |
| OCNG Patterns | | Config 1,2,3,4,5,6,7,8,9,10,11,12 | OP.1 | | | OP.1 | | |
| $N_{oc}$ Note 2 | dBm/15 KHz | Config 1,2,3,4,5,6,7,8,9,10,11,12 | -102 | | | | | |
| $N_{oc}$ Note 2 | dBm/SCS | Config 1,2,3,7,8,9 | -102 | | | | | |
| | | Config 4,5,6,10,11,12 | -99 | | | | | |
| SS-RSRP Note 3 | dBm/SCS | Config 1,2,3,7,8,9 | -86 | -86 | -86 | -86 | -86 | -86 |
| | | Config 4,5,6,10,11,12 | -83 | -83 | -83 | -83 | -83 | -83 |
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2,3,4,5,6,7,8,9,10,11,12 | 16 | 16 | 16 | 16 | 16 | 16 |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2,3,4,5,6,7,8,9,10,11,12 | 16 | 16 | 16 | 16 | 16 | 16 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Io[Note3] | dBm/9.36MHz | Config 1,2,3,7,8,9 | -57.9 | -57.9 | -57.9 | -57.9 | -57.9 | -57.9 |
| | dBm/38.16MHz | Config 4,5,6,10,11,12 | -51.8 | -51.8 | -51.8 | -51.8 | -51.8 | -51.8 |
| Propagation Condition | | | AWGN | | | | | |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | | | |

#### A.4.5.2.7.2 Test Requirements

The UE shall be continuously scheduled in PSCell during the entire test. During the time duration T2 the UE shall not miss transmitting two consequtive ACK/NACK on PSCell. During the time duration T3 the UE shall not miss transmitting two consequtive ACK/NACK on PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

## A.4.5.3 SCell Activation and Deactivation Delay

### A.4.5.3.1 SCell Activation and deactivation of known SCell in FR1 in non-DRX for 160ms SCell measurement cycle

#### A.4.5.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in section 8.3, when the SCell in FR1 is known by the UE at the time of activation.

The supported test configurations are shown in table A.4.5.3.1.1-1 below. The test parameters are given in Tables A.4.5.3.1-2 and cell-specific parameters in A. 4.5.3.1-3 below. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three carriers, E-UTRA has one cell, NR has two cells. All cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRA and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on NR. The UE now starts monitoring the SCell. The test equipment sends a MAC message for activation of the SCell.

The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted m, defines the start of time period T2. The UE shall be able to report valid CSI in PSCell for the activated SCell at latest in slot ($m+T_{HARQ}+T_{activation\_time}+T_{CSI\_Reporting}$), as defined in section 8.3. The UE shall start reporting CSI in PSCell in slot (m+k) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell or PSCell interruption due to activation of SCell shall occur in the slot ($m+1+[T_{HARQ}]$) to ($m+1+[T_{HARQ}+3ms+T_{SSB\_max}+T_{SMTC\_duration}]$), as defined in section 8.3.

Time period T3 starts when a MAC message for deactivation of SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot ($n+[T_{HARQ}+3ms]$), as defined in section 8.3, and any PCell and PSCell interruption due to the deactivation shall occur in the slot ($n+1+[T_{HARQ}]$) to ($n+1+[T_{HARQ}+3ms]$), as defined in section 8.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PSCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for SCell is discontinued.

**Table A.4.5.3.1.1-1: known FR1 SCell activation in non-DRX for 160ms SCell measurement cycle supported test configurations**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.4.5.3.1.1-2: General test parameters for known FR1 SCell activation case, 160ms SCell measurement cycle**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF Channel Number | | 1,2,3 | One E-UTRAN radio channel (1) and two NR radio channel (2,3) are used for this test |
| Active PCell | | Cell 1 | Primary cell on E-UTRAN RF channel number 1.<br>As specified in section A.3.7.2.1 |
| Active PSCell | | Cell 2 | Primary secondary cell on NR RF channel number 2. |
| Configured deactivated SCell | | Cell 3 | Configured deactivated secondary cell on NR RF channel number 3 |
| CP length | | Normal | |
| DRX | | OFF | Continuous monitoring of primary cell |
| CQI/PMI periodicity and offset configuration index | | 0 | CQI reporting for SCell every second subframe |
| Cell-individual offset for cells on E-UTRA RF channel number | dB | 0 | Individual offset for cells on primary component carrier. |
| Cell-individual offset for cells on NR channel number | dB | 0 | Individual offset for cells on secondary component carrier. |
| SCell measurement cycle (measCycleSCell) | ms | 160 | |
| Cell3 timing offset to cell2 | µs | 0 | |
| Time alignment error between cell3 and cell2 | µs | ≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1. | The value of time alignment error depends upon the type of carrier aggregation. |
| T1 | s | [7] | During this time the PSCell shall be known and the SCell configured and detected. |
| T2 | s | [1] | During this time the UE shall activate the SCell. |
| T3 | s | [1] | During this time the UE shall deactivate the SCell. |
| $T_{HARQ}$ | ms | TBD | the timing between DL data transmission and acknowledgement as specified in 38.321 [7] |
| $T_{CSI\_Reporting}$ | ms | [2] | the delay uncertainty in acquiring the first available CSI reporting resources as specified in 38.331 [2] |
| k | ms | TBD | As specified in section 4.3 of 38.213 |

**Table A. 4.5.3.1.1-2: Cell specific test parameters for known FR1 SCell activation case, 160ms SCell measurement cycle**

| Parameter | | Unit | Cell 2 | | | Cell 3 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| SSB ARFCN | | | freq1 | | | freq1 | | |
| Duplex mode | Config 1,4 | | FDD | | | | | |
| | Config 2,3,5,6 | | TDD | | | | | |
| TDD configuration | Config 1,4 | | Not Applicable | | | | | |
| | Config 2,5 | | TDDConf.1.1 | | | | | |
| | Config 3,6 | | TDDConf.1.2 | | | | | |
| $BW_{channel}$ | Config 1,4 | MHz | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 2,5 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 3,6 | | 40: $N_{RB,c}$ = 106 | | | | | |
| BWP BW | Config 1,4 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 2,5 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 3,6 | | 40: $N_{RB,c}$ = 106 | | | | | |
| DRx Cycle | | ms | Not Applicable | | | | | |
| PDSCH Reference measurement channel | Config 1,4 | | SR.1.1 FDD | | | SR.1.1 FDD | | |
| | Config 2,5 | | SR.1.1 TDD | | | SR.1.1 TDD | | |
| | Config 3,6 | | SR2.1 TDD | | | SR2.1 TDD | | |
| RMSI CORESET Reference Channel | Config 1,4 | | CR.1.1 FDD | | | CR.1.1 FDD | | |
| | Config 2,5 | | CR.1.1 TDD | | | CR.1.1 TDD | | |
| | Config 3,6 | | CR2.1 TDD | | | CR2.1 TDD | | |
| RMC CORESET Reference Channel | Config 1,4 | | CCR.1.1 FDD | | | CCR.1.1 FDD | | |
| | Config 2,5 | | CCR.1.1 TDD | | | CCR.1.1 TDD | | |
| | Config 3,6 | | CCR.2.1 TDD | | | CCR.2.1 TDD | | |
| OCNG Patterns | | | OCNG pattern 1 | | | | | |
| SMTC configuration | | | SMTC.1 | | | | | |
| SSB configuration | Config 1,2,4,5 | | SSB.1 FR1 | | | | | |
| | Config 3,6 | | SSB.2 FR1 | | | | | |
| PDSCH/PDCCH subcarrier spacing | Config 1,2,4,5 | kHz | 15 kHz | | | | | |
| | Config 3,6 | | 30kHz | | | | | |
| EPRE ratio of PSS to SSS | | dB | 0 | | | | | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | | |
| $N_{oc}$ Note2 | | dBm/15kHz | [-104] | | | | | |
| $N_{oc}$ Note2 | Config 1,2,4,5 | dBm/SCS | [-104] | | | | | |
| | Config 3,6 | | [-101] | | | | | |
| $\hat{E}_s/I_{ot}$ | | dB | [17] | | | | | |
| $\hat{E}_s/N_{oc}$ | | dB | [17] | | | | | |
| SS-RSRP Note3 | Config 1,2,4,5 | dBm/SCS | [-87] | | | | | |
| | Config 3,6 | | [-84] | | | | | |
| SCH_RP Note 3 | | dBm/15 kHz | [-87] | | | | | |
| Propagation condition | | - | AWGN | | | | | |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.]

#### A.4.5.3.1.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in a slot (m+k), or in a slot (m+1+[$T_{HARQ}$+3ms+$T_{SSB\_max}$+$T_{SMTC\_duration}$]+1) as defined in section 8.3 if the slot (m+k) was subject to interruption. Whether CSI report in slot (m+k) was interrupted or not is checked by monitoring ACK/NACK sent in PCell in slot (m+k).

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot (m+$T_{HARQ}$+$T_{activation\_time}$+$T_{CSI\_Reporting}$), $T_{activation\_time}$ = [3ms+$T_{SMTC\_SCell}$+2ms], as defined in section 8.3.

During T3 the UE shall stop sending CSI reports for SCell at latest in a slot (n+[$T_{HARQ}$+3ms]), as defined in section 8.3.

During T2 interruption of PCell / PSCell during SCell activation shall not happen outside the slot (m+1+[$T_{HARQ}$]) to (m+1+[$T_{HARQ}$+3ms+$T_{SSB\_max}$+$T_{SMTC\_duration}$]), as defined in section 8.3.

During T3 interruption of PCell / PSCell during SCell deactivation shall not happen outside the slot (n+1+[$T_{HARQ}$]) to (n+1+[$T_{HARQ}$+3ms]), as defined in section 8.3.

The interruption of PSCell shall not be more than the values specified for EN-DC in Section 8.2.1.2.4.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay and SCell deactivation delay during repeated tests shall be at least 90%.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot (m+$T_{HARQ}$+$T_{activation\_time}$+$T_{CSI\_Reporting}$) as defined in section 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

### A.4.5.3.2 SCell Activation and deactivation of known SCell in FR1 in non-DRX for 320ms SCell measurement cycle

#### A.4.5.3.2.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in section A.4.5.3.1.1. The supported test configurations are the same as defined in section A.4.5.3.1.1. The test parameters are the same except those described in the following section. The listed parameter values in Tables A.4.5.3.2.1-1 will replace the values of corresponding parameters in Tables A.4.5.3.1.1-1.

**Table A.4.5.3.2.1-1: General test parameters for known FR1 SCell activation case, 320ms SCell measurement cycle**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| SCell measurement cycle (measCycleSCell) | ms | 320 | |

#### A.4.5.3.2.2 Test Requirements

The test requirements defined in section A.4.5.3.1.2 shall apply to this test case, except $T_{activation\_time}$ will be replaced with the value [3ms+$T_{SMTC\_MAX}$+$T_{SMTC\_SCell}$+2ms].

### A.4.5.3.3 SCell Activation and deactivation of unknown SCell in FR1 in non-DRX

#### A.4.5.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in section 8.3, when the SCell in FR1 is unknown by the UE at the time of activation.

The supported test configurations are the same as defined in section A.4.5.3.1.1. The test parameters are the same except those described in the following section. The listed parameter values in Tables A.4.5.3.3.1-1 will replace the values of corresponding parameters in Tables A.4.5.3.1.1-1. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three carriers, E-UTRA has one cell, NR has two cells. Cell 1 and Cell 2 have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-

UTRAN and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on NR. During T1 the SCell is powered off and UE is not aware of SCell.

A MAC message for activation of SCell is sent by the test equipment [100ms] after the RRC message, in a slot # denoted m. The point in time at which the MAC message for activation of SCell is received at the UE antenna connector defines the start of time period T2. Immediately at beginning of T2 the transmission power of cell 3 is increased to same level as for cell 2. The UE shall be able to report valid CSI for the activated SCell at latest in slot ($m+T_{HARQ}+T_{activation\_time}+T_{CSI\_Reporting}$) as defined in section 8.3 provided the SCell can be successfully detected on the first attempt. The UE shall start reporting CSI in slot (m+k) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell interruption due to activation of SCell shall occur in the slot ($m+1+[T_{HARQ}]$) to ($m+1+[T_{HARQ}+3ms+T_{SSB\_max}+T_{SMTC\_duration}]$) as defined in section 8.3.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell at latest in slot ($n+[T_{HARQ}+3ms]$) as defined in section 8.3, and any PCell and PSCell interruption due to the deactivation shall occur in the ($n+1+[T_{HARQ}]$) to ($n+1+[T_{HARQ}+3ms]$) as defined in section 8.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PSCell during activation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell1 deactivation command is sent until CQI reporting for SCell1 is discontinued.

**Table A.4.5.3.3.1-1: General test parameters for unknown FR1 SCell activation case, 160ms SCell measurement cycle**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| T1 | ms | [100] | During this time the PSCell shall be known and the SCell configured, but not detected. |

#### A.4.5.3.1.2 Test Requirements

The test requirements defined in section A.4.5.3.1.2 shall apply to this test case, except $T_{activation\_time}$ will be replaced with the value [$3ms+2*T_{SMTC\_MAX}+2*T_{SMTC\_SCell}+2ms$] as defined in section 8.3.

## A.4.5.4 UE UL carrier RRC reconfiguration Delay

### A.4.5.4.1 Test Purpose and Environment

The purpose of this test is to verify that when the UE receives a RRC message implying NR UL or Supplementary UL carrier configuration, the UE shall be ready to start transmission on the newly configured carrier within the time limits specified in section 8.4.2 and 8.4.3 for configuring and deconfiguring, respectively.

There are three cells: E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and FR1 SCell (Cell 3). For SCell, both NR uplink and supplementary uplink are broadcast by *ServingCellConfigCommonSIB.* The test parameters for PSCell and SCell are given in Table A. 4.5.4.1-1, Table A. 4.5.4.1-2, Table A. 4.5.4.1-3 and Table A. 4.5.4.1-4 below. The test parameters and applicability for E-UTRAN PCell are defined in A.3.7.2. The test consists two tests. In test 1, the test consists of three time periods, with duration of T1, T2 and T3 respectively. During time duration T1, NR uplink of cell 2 is configured to UE. At the start of T2, a supplementary uplink of cell2 is configured to UE through *RRCReconfiguration*, then UE shall start transmission both on the NR uplink and supplementary uplink. At the start of T3, the supplementary uplink is released through *RRCReconfiguration*.

In test 2, the test consists of three time periods, with duration of T1, T2 and T3 respectively. During time duration T1, supplementray uplink on cell 3 is configured to UE. At the start of T2, a NR uplink is configured to UE through *RRCReconfiguration*, then UE shall start transmission both on the NR uplink and supplementary uplink. At the start of T3, the NR uplink is released through *RRCReconfiguration*.

**Table A.4.5.4.1-1: Supported test configurations**

| Configuration | PSCell (Cell2) | SCell (Cell3) |
|---|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | DL and UL: 15kHz SSB SCS, 10MHz bandwidth, FDD duplex mode;<br>SUL: 15kHz SCS, 10MHz bandwidth, SUL duplex mode |
| 2 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | DL and UL: 15kHz SSB SCS, 10MHz bandwidth, TDD duplex mode;<br>SUL: 15kHz SCS, 10MHz bandwidth, SUL duplex mode |
| 3 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | DL and UL: 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode;<br>SUL: 30kHz SCS, 40MHz bandwidth, SUL duplex mode |
| 4 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | DL and UL: 15kHz SSB SCS, 10MHz bandwidth, FDD duplex mode;<br>SUL: 15kHz SCS, 10MHz bandwidth, SUL duplex mode |
| 5 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | DL and UL: 15kHz SSB SCS, 10MHz bandwidth, TDD duplex mode;<br>SUL: 15kHz SCS, 10MHz bandwidth, SUL duplex mode |
| 6 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | DL and UL: 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode;<br>SUL: 30kHz SCS, 40MHz bandwidth, SUL duplex mode |
| 7 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | DL and UL: 15kHz SSB SCS, 10MHz bandwidth, FDD duplex mode;<br>SUL: 15kHz SCS, 10MHz bandwidth, SUL duplex mode |
| 8 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | DL and UL: 15kHz SSB SCS, 10MHz bandwidth, TDD duplex mode;<br>SUL: 15kHz SCS, 10MHz bandwidth, SUL duplex mode |
| 9 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | DL and UL: 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode;<br>SUL: 30kHz SCS, 40MHz bandwidth, SUL duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | | |

**Table A.4.5.4.1-2: General test parameters for EN-DC UE UL carrier RRC reconfiguration Delay**

| Parameter | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|
| RF Channel Number | | Config 1,2,3, 4, 5, 6, 7, 8, 9 | 1, 2, 3 | Three radio channels are used for these two tests. |
| Active cell | | Config 1,2,3, 4, 5, 6, 7, 8, 9 | Cell 1: E-UTRAN PCell<br>Cell 2: FR1 PSCell<br>Cell 3: FR1 SCell | E-UTRAN PCell on RF channel number 1<br>FR1 PSCell on RF channel number 2<br>FR1 SCell on RF channel number 3 |
| CP length | | Config 1,2,3, 4, 5, 6, 7, 8, 9 | Normal | |
| DRX | | Config 1,2,3, 4, 5, 6, 7, 8, 9 | OFF | |
| Measurement gap pattern Id | | Config 1,2,3, 4, 5, 6, 7, 8, 9 | OFF | |
| Filter coefficient | | Config 1,2,3, 4, 5, 6, 7, 8, 9 | 0 | L3 filtering is not used |
| T1 | s | Config 1,2,3, 4, 5, 6, 7, 8, 9 | 5 | |
| T2 | s | Config 1,2,3, 4, 5, 6, 7, 8, 9 | 5 | |
| T3 | s | Config 1,2,3, 4, 5, 6, 7, 8, 9 | 5 | |

**Table A.4.5.4.1-3: NR Cell specific test parameters for EN-DC UE UL carrier RRC reconfiguration Delay on PSCell (Cell 2)**

| Parameter | Unit | Test Configuration | Test 1 | | | Test 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Channel number | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 2 | | | 2 | | |
| TDD configuration | | Conf 1, 2, 3 | N/A | | | N/A | | |
| | | Conf 4, 5, 6 | TDD Conf.1.1 | | | TDD Conf.1.1 | | |
| | | Conf 7, 8, 9 | TDD Conf.2.1 | | | TDD Conf.2.1 | | |
| $BW_{channel}$ | MHz | Conf 1, 2, 3 | 10: $N_{RB,c}$ = 52 | | | 10: $N_{RB,c}$ = 52 | | |
| | | Conf 4, 5, 6 | 10: $N_{RB,c}$ = 52 | | | 10: $N_{RB,c}$ = 52 | | |
| | | Conf 7, 8, 9 | 40: $N_{RB,c}$ = 106 | | | 40: $N_{RB,c}$ = 106 | | |
| PDSCH reference measurement channel as defined in A.3.1.1 | | Conf 1, 2, 3 | SR.1.1 FDD | | | SR.1.1 FDD | | |
| | | Conf 4, 5, 6 | SR.1.1 TDD | | | SR.1.1 TDD | | |
| | | Conf 7, 8, 9 | SR 2.1 TDD | | | SR 2.1 TDD | | |
| RMSI CORESET reference measurement channel as defined in A.3.1.2 | | Conf 1, 2, 3 | CR.1.1 FDD | | | CR.1.1 FDD | | |
| | | Conf 4, 5, 6 | CR.1.1 TDD | | | CR.1.1 TDD | | |
| | | Conf 7, 8, 9 | CR.2.1 TDD | | | CR.2.1 TDD | | |
| RMC CORESET reference measurement channel as defined in A.3.1.3 | | Conf 1, 2, 3 | CCR.1.1 FDD | | | CCR.1.1 FDD | | |
| | | Conf 4, 5, 6 | CCR.1.1 TDD | | | CCR.1.1 TDD | | |
| | | Conf 7, 8, 9 | CCR.2.1 TDD | | | CCR.2.1 TDD | | |
| OCNG Pattern Note 1 | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | OP.1 | | | OP.1 | | |
| SSB configuration | | Conf 1, 2, 3, 4, 5, 6 | SSB.1 FR1 | | | SSB.1 FR1 | | |
| | | Conf 7, 8, 9 | SSB.2 FR1 | | | SSB.2 FR1 | | |
| SMTC configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | SMTC.1 | | | SMTC.1 | | |
| DL initial BWP configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | DLBWP.0.1 | | | DLBWP.0.1 | | |
| DL dedicated BWP configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | DLBWP.1.1 | | | DLBWP.1.1 | | |
| UL dedicated BWP configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | ULBWP.1.1 | | | ULBWP.1.1 | | |
| EPRE ratio of PSS to SSS | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 0 | | | 0 | | |
| EPRE ratio of PBCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | | | | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | | | | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS | | | | | | | | |
| $N_{oc}$ Note 2 | dBm / 15kHz | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | -102 | | | -102 | | |
| | dBm/ SCS | Conf 1,2,3,4,5,6 | -102 | | | -102 | | |
| | | Conf 7,8,9 | -99 | | | -99 | | |
| $\hat{E}_s/N_{oc}$ | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 16 | 16 | 16 | 16 | 16 | 16 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\hat{E}_s/I_{ot}$ Note 3 | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 16 | 16 | 16 | 16 | 16 | 16 |
| SS-RSRP Note 3 | dBm/ SCS | Conf 1,2,3,4,5,6 | -86 | -86 | -86 | -86 | -86 | -86 |
| | | Conf 7,8,9 | -83 | -83 | -83 | -83 | -83 | -83 |
| Io Note 3 | dBm/ 9.36 MHz | Conf 1,2,3,4,5,6 | -57.9 | -57.9 | -57.9 | -57.9 | -57.9 | -57.9 |
| | dBm/ 38.16 MHz | Conf 7,8,9 | -51.8 | -51.8 | -51.8 | -51.8 | -51.8 | -51.8 |
| Propagation Condition | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | AWGN | | | AWGN | | |
| Antenna configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 1 x 2 | | | 1 x 2 | | |

NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
NOTE 3: $\hat{E}_s/I_{ot}$, Io, and SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

**Table A.4.5.4.1-4: NR Cell specific test parameters for EN-DC UE UL carrier RRC reconfiguration Delay on SCell (Cell 3)**

| Parameter | Unit | Test Configuration | Test 1 | | | Test 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Channel number | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 3 | | | 3 | | |
| TDD configuration | | Conf 1, 4, 7 | N/A | | | N/A | | |
| | | Conf 2, 5, 8 | TDDConf.1.1 | | | TDDConf.1.1 | | |
| | | Conf 3, 6, 9 | TDDConf.2.1 | | | TDDConf.2.1 | | |
| $BW_{channel}$ | MHz | Conf 1, 4, 7 | 10: $N_{RB,c}$ = 52 | | | 10: $N_{RB,c}$ = 52 | | |
| | | Conf 2, 5, 8 | 10: $N_{RB,c}$ = 52 | | | 10: $N_{RB,c}$ = 52 | | |
| | | Conf 3, 6, 9 | 40: $N_{RB,c}$ = 106 | | | 40: $N_{RB,c}$ = 106 | | |
| PUSCH parameters for NR UL carrier | | Conf 1, 4, 7 | [TBD] | [TBD] | [TBD] | N/A | [TBD] | N/A |
| | | Conf 2, 5, 8 | [TBD] | [TBD] | [TBD] | N/A | [TBD] | N/A |
| | | Conf 3, 6, 9 | [TBD] | [TBD] | [TBD] | N/A | [TBD] | N/A |
| PUCCH parameters For NR UL carrier | | Conf 1, 4, 7 | [TBD] | [TBD] | [TBD] | N/A | [TBD] | N/A |
| | | Conf 2, 5, 8 | [TBD] | [TBD] | [TBD] | N/A | [TBD] | N/A |
| | | Conf 3, 6, 9 | [TBD] | [TBD] | [TBD] | N/A | [TBD] | N/A |
| PUSCH parameters for supplementary UL | | Conf 1, 4, 7 | N/A | [TBD] | N/A | [TBD] | [TBD] | [TBD] |
| | | Conf 2, 5, 8 | N/A | [TBD] | N/A | [TBD] | [TBD] | [TBD] |
| | | Conf 3, 6, 9 | N/A | [TBD] | N/A | [TBD] | [TBD] | [TBD] |
| PUCCH parameters for supplementary UL | | Conf 1, 4, 7 | N/A | [TBD] | N/A | [TBD] | [TBD] | [TBD] |
| | | Conf 2, 5, 8 | N/A | [TBD] | N/A | [TBD] | [TBD] | [TBD] |
| | | Conf 3, 6, 9 | N/A | [TBD] | N/A | [TBD] | [TBD] | [TBD] |
| PDSCH reference measurement channel as defined in A.3.1.1 | | Conf 1, 4, 7 | SR.1.1 FDD | | | SR.1.1 FDD | | |
| | | Conf 2, 5, 8 | SR.1.1 TDD | | | SR.1.1 TDD | | |
| | | Conf 3, 6, 9 | SR 2.1 TDD | | | SR 2.1 TDD | | |
| RMSI CORESET reference measurement channel as defined in A.3.1.2 | | Conf 1, 4, 7 | CR.1.1 FDD | | | CR.1.1 FDD | | |
| | | Conf 2, 5, 8 | CR.1.1 TDD | | | CR.1.1 TDD | | |
| | | Conf 3, 6, 9 | CR.2.1 TDD | | | CR.2.1 TDD | | |
| RMC CORESET reference measurement channel as defined in A.3.1.3 | | Conf 1, 4, 7 | CCR.1.1 FDD | | | CCR.1.1 FDD | | |
| | | Conf 2, 5, 8 | CCR.1.1 TDD | | | CCR.1.1 TDD | | |
| | | Conf 3, 6, 9 | CCR.2.1 TDD | | | CCR.2.1 TDD | | |
| OCNG Pattern Note 1 | | Conf 1, 2, 3 | OP.1 | | | OP.1 | | |
| SSB configuration | | Conf 1, 2, 4, 5, 7,8 | SSB.1 FR1 | | | SSB.1 FR1 | | |
| | | Conf 3, 6, 9 | SSB.2 FR1 | | | SSB.2 FR1 | | |
| SMTC configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | SMTC.1 | | | SMTC.1 | | |
| DL initial BWP configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | DLBWP.0.1 | | | DLBWP.0.1 | | |
| DL dedicated BWP configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | DLBWP.1.1 | | | DLBWP.1.1 | | |
| UL dedicated BWP configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | ULBWP.1.1 | | | ULBWP.1.1 | | |
| EPRE ratio of PSS to SSS | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 0 | | | 0 | | |
| EPRE ratio of PBCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | | | | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | | | | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| EPRE ratio of OCNG DMRS to SSS | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS | | | | | | | | |
| $N_{oc}$ Note 2 | dBm / 15kHz | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | -102 | | | -102 | | |
| | dBm/ SCS | Conf 1, 2, 4, 5, 7,8 | -102 | | | -102 | | |
| | | Conf 3, 6, 9 | -99 | | | -99 | | |
| $\hat{E}_s/N_{oc}$ | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 16 | 16 | 16 | 16 | 16 | 16 |
| $\hat{E}_s/I_{ot}$ Note 3 | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 16 | 16 | 16 | 16 | 16 | 16 |
| SS-RSRP Note 3 | dBm/ SCS | Conf 1, 2, 4, 5, 7,8 | -86 | -86 | -86 | -86 | -86 | -86 |
| | | Conf 3, 6, 9 | -83 | -83 | -83 | -83 | -83 | -83 |
| Io Note 3 | dBm/ 9.36 MHz | Conf 1, 2, 4, 5, 7,8 | -57.9 | -57.9 | -57.9 | -57.9 | -57.9 | -57.9 |
| | dBm/ 38.16 MHz | Conf 3, 6, 9 | -51.8 | -51.8 | -51.8 | -51.8 | -51.8 | -51.8 |
| Propagation Condition | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | AWGN | | | AWGN | | |
| Antenna configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 1 x 2 | | | 1 x 2 | | |
| NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>NOTE 3: $\hat{E}_s/I_{ot}$, Io, and SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | | | |

#### A.4.5.4.2 Test Requirements

In test 1 the UE shall be ready to start transmission on the supplementary uplink carrier on SCell within [20]ms from the start of T2.

In test 1 the UE shall stop the transmission on the supplementary uplink carrier on SCell within [20]ms from the start of T3.

In test 2 the UE shall be ready to start transmission on the NR uplink carrier on SCell within [20]ms from the start of T2.

In test 2 the UE shall stop the transmission on the NR uplink carrier on SCell within [20]ms from the start of T3.

All of the above test requirements shall be fulfilled in order for the observed UE UL carrier configuration delay and UE UL carrier release delay to be counted as correct. The rate of correct observed UE UL carrier configuration delay and UE UL carrier release delay during repeated tests shall be at least 90%.

### A.4.5.5 Beam Failure Detection and Link recovery procedures

#### A.4.5.5.1 EN-DC Beam Failure Detection and Link Recovery Test for FR1 PSCell configured with SSB-based BFD and LR in non-DRX mode

*Editor's note: It is open whether BFD can be based on SSB. This test case will be updated accordingly.*

##### A.4.5.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set $q_0$ configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candicate set $q_1$. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.4.5.5.1.1-1, A.4.5.5.1.1-2, A.4.5.5.1.1-3 and A.4.5.5.1.1-4 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.1.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB in set $q_0$ in the active PSCell to emulate SSB based beam failure. Figure A.4.5.5.1.1-1 additionally shows the variation of the downlink SNR of the SSB in set $q_1$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 2.

**Table A.4.5.5.1.1-1: Supported test configurations for FR1 PCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.4.5.5.1.1-2: General test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode**

| Parameter | | Unit | Value: Test 1 | Value: Test 2 | Comment |
|---|---|---|---|---|---|
| Active PCell | | | Cell 1 | Cell 1 | |
| RF Channel Number | | | 1 | 1 | |
| Duplex mode | Config 1, 4 | | FDD | FDD | |
| | Config 2, 3, 5, 6 | | TDD | TDD | |
| TDD Configuration | Config 1, 4 | | Not Applicable | Not Applicable | |
| | Config 2, 5 | | [TDDConf.1.1] | [TDDConf.1.1] | |
| | Config 3, 6 | | [TDDConf.1.2] | [TDDConf.1.2] | |
| CORESET Reference Channel | Config 1, 4 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] | |
| | Config 2, 5 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] | |
| | Config 3, 6 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] | |
| SSB Configuration | Config 1, 4 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| | Config 2, 5 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| | Config 3, 6 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| SMTC Configuration | Config 1, 2, 4, 5 | | FR1 patterm 1 | FR1 patterm 1 | |
| | Config 3, 6 | | FR1 pattern 2 | FR1 pattern 2 | |
| PDSCH/ PDCCH subcarrier spacing | Config 1, 2, 4, 5 | | 15 KHz | 15 KHz | |
| | Config 3, 6 | | 30 KHz | 30 KHz | |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] | |
| OCNG parameters | | | TBD | TBD | |
| CP length | | | Normal | Normal | |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] | |
| Beam failure detection transmission parameters | DCI format | | 1-0 | 1-0 | |
| | Number of Control OFDM symbols | | 2 | 2 | |
| | Aggregation level | CCE | 8 | 8 | |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | DMRS precoder granularity | | REG bundle size | REG bundle size | |

| | | | | | |
|---|---|---|---|---|---|
| | REG bundle size | | 6 | 6 | |
| DRX | | | OFF | OFF | |
| Gap pattern ID | | | [N.A.] | *[*gp0*] | |
| ssb-Index | | | 2 | 2 | Number of SSB indexes used for beam failure detection |
| rlmInSyncOutOfSync Threshold | | | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | | TBD | TBD | Threshold used for $Q_{out\_LR\_SSB}$ |
| powerControlOffsetSS | | | NA | NA | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstance MaxCount | | | [n2] | [n2] | see TS 38.321 [7], section 5.17 |
| beamFailureDetection Timer | | | [pbfd4] | [pbfd4] | see TS 38.321 [7], section 5.17 |
| ZP CSI-RS configuation | | | TBD | TBD | |
| CSI-IM configuration | | | TBD | TBD | |
| Periodic CSI reporting | | | PUCCH | PUCCH | |
| CSI reporting periodicity | Config 1, 2, 4, 5 | slot | [5] | [5] | |
| | Config 3, 6 | | [10] | [10] | |
| T1 | | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | s | 0.4 | 0.4 | |
| T3 | | s | [0.6] | [0.6] | |
| D1 | | s | [0.24] | [0.44] | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

**Table A.4.5.5.1.1-3: Cell specific test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode**

| Parameter | | Unit | Test 1 and Test 2 | | | | | Test 1 and Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SSB of set $q_0$ | | | | | SSB of set $q_1$ | | | | |
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| PDCCH_beta | | dB | 4 | | | | | 4 | | | | |
| PDCCH_DMRS_beta | | dB | 4 | | | | | 4 | | | | |
| PBCH_beta | | dB | 0 | | | | | 0 | | | | |
| PSS_beta | | dB | | | | | | | | | | |
| SSS_beta | | dB | | | | | | | | | | |
| PDSCH_beta | | dB | | | | | | | | | | |
| OCNG_beta | | dB | | | | | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | | | [-98] | | | | |
| | Config 2 | | [-98] | | | | | [-98] | | | | |
| | Config 3 | | [-98] | | | | | [-98] | | | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | | | [TDL-C 300ns 100Hz] | | | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.4.5.5.1.1-4: Measurement gap configuration for FR1 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

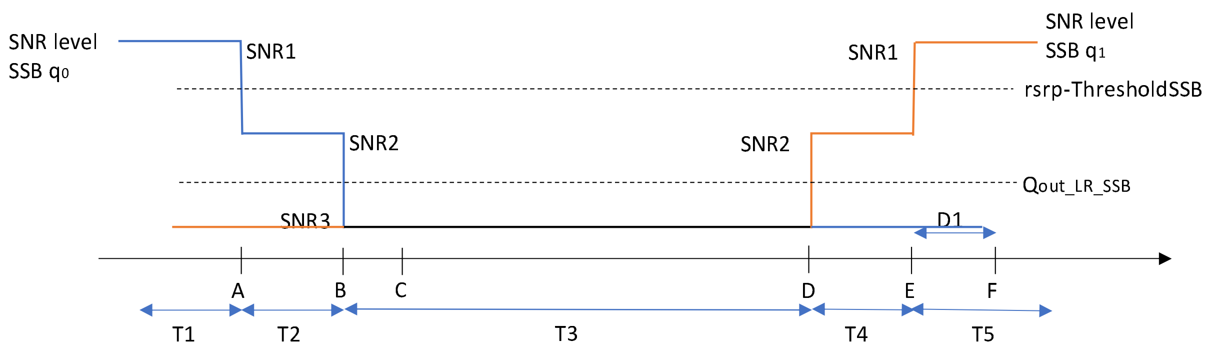


**Figure A.4.5.5.1.1-1: SNR variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode**

#### A.4.5.5.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_1$.

No later than time point F occurring no later than D1 = [TBD] ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set $q_1$.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

### A.4.5.5.2 EN-DC Beam Failure Detection and Link Recovery Test for FR1 PSCell configured with SSB-based BFD and LR in DRX mode

*Editor's note: It is open whether BFD can be based on SSB. This test case will be updated accordingly.*

#### A.4.5.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set $q_0$ configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candicate set $q_1$. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.4.5.5.2.1-1, A.4.5.5.2.1-2, A.4.5.5.2.1-3, A.4.5.5.2.1-4 and A.4.5.5.2.1-5 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.2.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB in set $q_0$ in the active PSCell to emulate SSB based beam failure. Figure A.4.5.5.2.1-1 additionally shows the variation of the downlink SNR of the SSB in set $q_1$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is enabled in PSCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 2.

**Table A.4.5.5.2.1-1: Supported test configurations for FR1 PCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.4.5.5.2.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode**

| Parameter | | Unit | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active PCell | | | Cell 1 | Cell 1 | |
| RF Channel Number | | | 1 | 1 | |
| Duplex mode | Config 1, 4 | | FDD | FDD | |
| | Config 2, 3, 5, 6 | | TDD | TDD | |
| TDD Configuration | Config 1, 4 | | Not Applicable | Not Applicable | |
| | Config 2, 5 | | [TDDConf.1.1] | [TDDConf.1.1] | |
| | Config 3, 6 | | [TDDConf.1.2] | [TDDConf.1.2] | |
| CORESET Reference Channel | Config 1, 4 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] | |
| | Config 2, 5 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] | |
| | Config 3, 6 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] | |
| SSB Configuration | Config 1, 4 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| | Config 2, 5 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| | Config 3, 6 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| SMTC Configuration | Config 1, 2, 4, 5 | | FR1 patterm 1 | FR1 patterm 1 | |
| | Config 3, 6 | | FR1 pattern 2 | FR1 pattern 2 | |
| PDSCH/ PDCCH subcarrier spacing | Config 1, 2, 4, 5 | | 15 KHz | 15 KHz | |
| | Config 3, 6 | | 30 KHz | 30 KHz | |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] | |
| OCNG parameters | | | TBD | TBD | |
| CP length | | | Normal | Normal | |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] | |
| Beam failure detection transmission parameters | DCI format | | 1-0 | 1-0 | |
| | Number of Control OFDM symbols | | 2 | 2 | |
| | Aggregation level | CCE | 8 | 8 | |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | DMRS precoder granularity | | REG bundle size | REG bundle size | |

| | | | | | |
|---|---|---|---|---|---|
| | REG bundle size | | 6 | 6 | |
| DRX | | | 640 | 640 | |
| Gap pattern ID | | | [N.A.] | *[*gp0*] | |
| ssb-Index | | | 2 | 2 | Number of SSB indexes used for beam failure detection |
| rlmInSyncOutOfSync Threshold | | | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | | TBD | TBD | Threshold used for $Q_{out\_LR\_SSB}$ |
| powerControlOffsetSS | | | NA | NA | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstance MaxCount | | | [n2] | [n2] | see TS 38.321 [7], section 5.17 |
| beamFailureDetection Timer | | | [pbfd4] | [pbfd4] | see TS 38.321 [7], section 5.17 |
| ZP CSI-RS configuation | | | TBD | TBD | |
| CSI-IM configuration | | | TBD | TBD | |
| Periodic CSI reporting | | | PUCCH | PUCCH | |
| CSI reporting periodicity | Config 1, 2, 4, 5 | slot | [5] | [5] | |
| | Config 3, 6 | | [10] | [10] | |
| T1 | | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | s | 0.4 | 0.4 | |
| T3 | | s | [0.6] | [0.6] | |
| D1 | | s | [0.24] | [0.44] | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

**Table A.4.5.5.2.1-3: Cell specific test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode**

| Parameter | | Unit | Test 1 and Test 2 | | | | | Test 1 and Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SSB of set $q_0$ | | | | | SSB of set $q_1$ | | | | |
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| PDCCH_beta | | dB | 4 | | | | | 4 | | | | |
| PDCCH_DMRS_beta | | dB | 4 | | | | | 4 | | | | |
| PBCH_beta | | dB | 0 | | | | | 0 | | | | |
| PSS_beta | | dB | | | | | | | | | | |
| SSS_beta | | dB | | | | | | | | | | |
| PDSCH_beta | | dB | | | | | | | | | | |
| OCNG_beta | | dB | | | | | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15K Hz | [-98] | | | | | [-98] | | | | |
| | Config 2 | | [-98] | | | | | [-98] | | | | |
| | Config 3 | | [-98] | | | | | [-98] | | | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | | | [TDL-C 300ns 100Hz] | | | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.2.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.4.5.5.2.1-4: Measurement gap configuration for FR1 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

**Table A.4.5.5.2.1-5: DRX-Configuration for FR1 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode.**

| Field | Test 5 | Test 6 |
|---|---|---|
| | Value | Value |
| drx-onDurationTimer | [ms6] | [ms6] |
| drx-InactivityTimer | [ms1] | [ms1] |
| drx-RetransmissionTimerDL | [sl1] | [sl1] |
| drx-RetransmissionTimerUL | [sl1] | [sl1] |
| longDRX-CycleStartOffset | [ms640] | [ms40] |
| shortDRX | disable | disable |

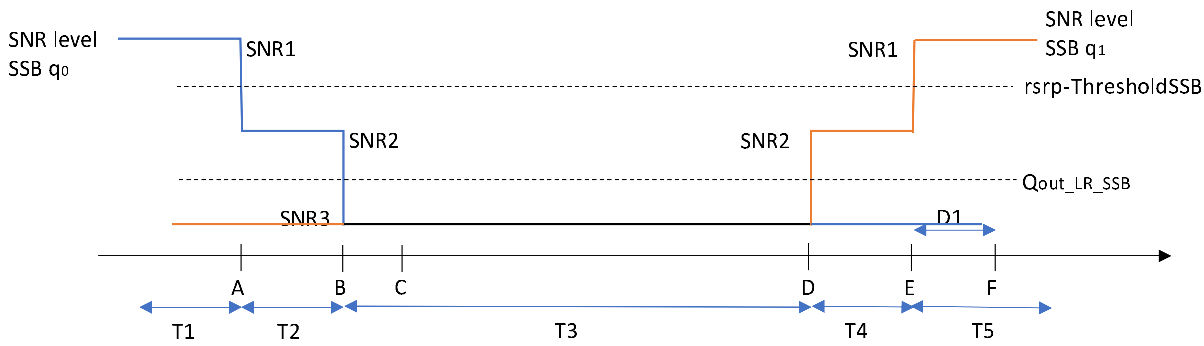


Figure A.4.5.5.2.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

#### A.4.5.5.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_1$.

No later than time point F occurring no later than D1 = [TBD] ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set $q_1$.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

### A.4.5.5.3 EN-DC Beam Failure Detection and Link Recovery Test for FR1 PSCell configured with CSI-RS-based BFD and LR in non-DRX mode

#### A.4.5.5.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set $q_0$ configured for a serving PSCell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set $q_1$. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.4.5.5.3.1-1, A.4.5.5.3.1-2, A.4.5.5.3.1-3, A.4.5.5.3.1-4 and A.4.5.5.3.1-5 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.3.1-1 shows the variation of the downlink SNR of the PSCell and the SNR of the CSI-RS in set $q_0$ in the active PSCell to emulate CSI-RS based beam failure. Figure A.4.5.5.3.1-1 additionally shows the variation of the downlink SNR of the CSI-RS in set $q_1$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cel 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 2.

**Table A.4.5.5.3.1-1: Supported test configurations for FR1 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.4.5.5.3.1-2: General test parameters for FR1 PSCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode**

| Parameter | | Unit | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active PCell | | | Cell 1 | Cell 1 | |
| RF Channel Number | | | 1 | 1 | |
| Duplex mode | Config 1, 4 | | FDD | FDD | |
| | Config 2, 3, 5, 6 | | TDD | TDD | |
| TDD Configuration | Config 1, 4 | | Not Applicable | Not Applicable | |
| | Config 2, 5 | | [TDDConf.1.1] | [TDDConf.1.1] | |
| | Config 3, 6 | | [TDDConf.1.2] | [TDDConf.1.2] | |
| CORESET Reference Channel | Config 1, 4 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] | A.3.1.2 |
| | Config 2, 5 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] | |
| | Config 3, 6 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] | |
| SSB Configuration | Config 1, 4 | | SSB.1 FR1 | SSB.1 FR1 | A.3.10 |
| | Config 2, 5 | | SSB.1 FR1 | SSB.1 FR1 | |
| | Config 3, 6 | | SSB.2 FR1 | SSB.2 FR1 | |
| SMTC Configuration | Config 1, 2, 4, 5 | | FR1 pattern 1 | FR1 pattern 1 | A.3.11 |
| | Config 3, 6 | | FR1 pattern 2 | FR1 pattern 2 | |
| PDSCH/ PDCCH subcarrier spacing | Config 1, 2, 4, 5 | | 15 KHz | 15 KHz | |
| | Config 3, 6 | | 30 KHz | 30 KHz | |
| csi-RS-Index assigned as beam failure RS | | | [0] | [0] | |
| OCNG parameters | | | TBD | TBD | A.3.2.1 |
| CP length | | | Normal | Normal | |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] | |
| Beam failure detection transmission parameters | DCI format | | 1-0 | 1-0 | |
| | Number of Control OFDM symbols | | 2 | 2 | |
| | Aggregation level | CCE | 8 | 8 | |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 | |

| | | | | | |
|---|---|---|---|---|---|
| | DMRS precoder granularity | | REG bundle size | REG bundle size | |
| | REG bundle size | | 6 | 6 | |
| DRX | | | OFF | OFF | |
| Gap pattern ID | | | [N.A.] | *[*gp0*] | |
| csi-RS-Index | | | 2 | 2 | Number of SSB indexes used for beam failure detection |
| rlmInSyncOutOfSync Threshold | | | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | | TBD | TBD | Threshold used for $Q_{out\_LR\_SSB}$ |
| powerControlOffsetSS | | | db0 | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstance MaxCount | | | n2 | n2 | see TS 38.321 [7], section 5.17 |
| beamFailureDetection Timer | | | pbfd4 | pbfd4 | see TS 38.321 [7], section 5.17 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] | |
| ZP CSI-RS configuation | | | TBD | TBD | |
| CSI-IM configuration | | | TBD | TBD | |
| Periodic CSI reporting | | | PUCCH | PUCCH | |
| CSI reporting periodicity | Config 1, 2, 4, 5 | slot | [5] | [5] | |
| | Config 3, 6 | | [10] | [10] | |
| T1 | | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | s | 0.4 | 0.4 | |
| T3 | | s | [TBD] | [TBD] | |
| D1 | | s | [0.24] | [0.44] | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

**Table A.4.5.5.3.1-3: Cell specific test parameters for FR1 PSCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode**

| Parameter | | Unit | Test 1 and Test 2 | | | | | Test 1 and Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CSI-RS of set $q_0$ | | | | | CSI-RS of set $q_1$ | | | | |
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PSS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PBCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | dB | | | 0 | | | | | 0 | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS (Note 1) | | dB | | | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | dB | | | | | | | | | | |
| SNR_CSI-RS | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | | | [-98] | | | | |
| | Config 2 | | [-98] | | | | | [-98] | | | | |
| | Config 3 | | [-98] | | | | | [-98] | | | | |
| SS-RSRP (Note 3) | | dBm/SCS | | | | | | | | | | |
| $\hat{E}_s/I_{ot}$ | | | | | | | | | | | | |
| $\hat{E}_s/N_{oc}$ | | | | | | | | | | | | |
| Io | config 1, 2 | dBm/9.36 MHz | | | | | | | | | | |
| | Config 3, 4 | dBm/38.1 MHz | | | | | | | | | | |
| Propagation condition | | | [TDLC300] | | | | | [TDLC300] | | | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

**Table A.4.5.5.3.1-4: Measurement gap configuration for FR1 PSCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

**Table A.4.5.5.3.1-5: NZP-CSI-RS resource configuration for FR1 PSCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation Note 1 | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.4.5.1.7.1-1 | | |

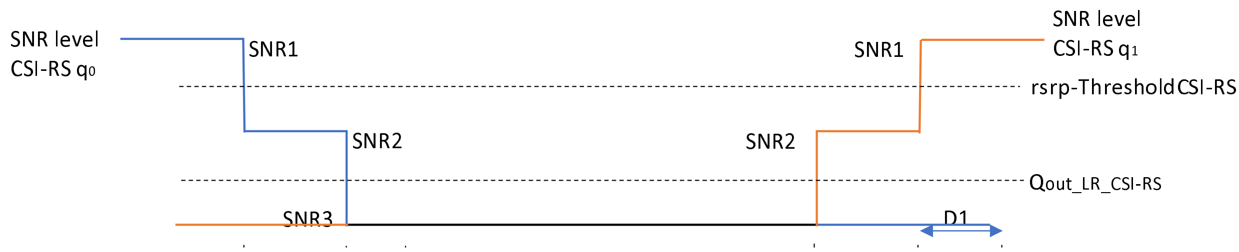


Figure A.4.5.5.3.1-1: SNR variation SSB for CSI-rs-based beam failure detection and link recovery testing in non-DRX mode

### A.4.5.5.3.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_1$.

No later than time point F occurring no later than D1 = [TBD] ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set $q_1$.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

## A.4.5.5.4 EN-DC Beam Failure Detection and Link Recovery Test for FR1 PSCell configured with CSI-RS-based BFD and LR in DRX mode

### A.4.5.5.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set $q_0$ configured for a serving PSCell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set $q_1$. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.4.5.1.4.1-1, A.4.5.1.4.1-2, A.4.5.1.4.1-3, A.4.5.1.4.1-4, A.4.5.1.4.1-5 and A.4.5.1.4.1-6 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.1.4.1-1 shows the variation of the downlink SNR of the PSCell and the SNR of the CSI-RS in set $q_0$ in the active PSCell to emulate CSI-RS based beam failure. Figure A.4.5.1.4.1-1 additionally shows the variation of the downlink SNR of the

CSI-RS in set $q_1$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is enabled in PSCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 2.

**Table A.4.5.1.4.1-1: Supported test configurations for FR1 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.4.5.1.1.1-2: General test parameters for FR1 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

| Parameter | | Unit | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active PCell | | | Cell 1 | Cell 1 | |
| RF Channel Number | | | 1 | 1 | |
| Duplex mode | Config 1, 4 | | FDD | FDD | |
| | Config 2, 3, 5, 6 | | TDD | TDD | |
| TDD Configuration | Config 1, 4 | | Not Applicable | Not Applicable | |
| | Config 2, 5 | | [TDDConf.1.1] | [TDDConf.1.1] | |
| | Config 3, 6 | | [TDDConf.1.2] | [TDDConf.1.2] | |
| CORESET Reference Channel | Config 1, 4 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] | A.3.1.2 |
| | Config 2, 5 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] | |
| | Config 3, 6 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] | |
| SSB Configuration | Config 1, 4 | | SSB.1 FR1 | SSB.1 FR1 | A.3.10 |
| | Config 2, 5 | | SSB.1 FR1 | SSB.1 FR1 | |
| | Config 3, 6 | | SSB.2 FR1 | SSB.2 FR1 | |
| SMTC Configuration | Config 1, 2, 4, 5 | | FR1 pattern 1 | FR1 pattern 1 | A.3.11 |
| | Config 3, 6 | | FR1 pattern 2 | FR1 pattern 2 | |
| PDSCH/ PDCCH subcarrier spacing | Config 1, 2, 4, 5 | | 15 KHz | 15 KHz | |
| | Config 3, 6 | | 30 KHz | 30 KHz | |
| csi-RS-Index assigned as beam failure RS | | | [0] | [0] | |
| OCNG parameters | | | TBD | TBD | A.3.2.1 |
| CP length | | | Normal | Normal | |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] | |
| Beam failure detection transmission parameters | DCI format | | 1-0 | 1-0 | |
| | Number of Control OFDM symbols | | 2 | 2 | |
| | Aggregation level | CCE | 8 | 8 | |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 | |

| | | | | | |
|---|---|---|---|---|---|
| | DMRS precoder granularity | | REG bundle size | REG bundle size | |
| | REG bundle size | | 6 | 6 | |
| DRX | | | 640 | 640 | |
| Gap pattern ID | | | [N.A.] | *[*gp0*] | |
| csi-RS-Index | | | 2 | 2 | Number of SSB indexes used for beam failure detection |
| rlmInSyncOutOfSync Threshold | | | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | | TBD | TBD | Threshold used for $Q_{out\_LR\_SSB}$ |
| powerControlOffsetSS | | | db0 | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstance MaxCount | | | [n2] | [n2] | see TS 38.321 [7], section 5.17 |
| beamFailureDetection Timer | | | [pbfd4] | [pbfd4] | see TS 38.321 [7], section 5.17 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] | |
| ZP CSI-RS configuation | | | TBD | TBD | |
| CSI-IM configuration | | | TBD | TBD | |
| Periodic CSI reporting | | | PUCCH | PUCCH | |
| CSI reporting periodicity | Config 1, 2, 4, 5 | slot | [5] | [5] | |
| | Config 3, 6 | | [10] | [10] | |
| T1 | | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | s | 0.4 | 0.4 | |
| T3 | | s | [TBD] | [TBD] | |
| D1 | | s | [0.24] | [0.44] | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

**Table A.4.5.1.4.1-3: Cell specific test parameters for FR1 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

| Parameter | | Unit | Test 1 and Test 2 | | | | | Test 1 and Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CSI-RS of set $q_0$ | | | | | CSI-RS of set $q_1$ | | | | |
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PSS to SSS | | dB | 0 | | | | | 0 | | | | |
| EPRE ratio of PBCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | dB | | | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | dB | | | | | | | | | | |
| SNR_CSI-RS | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | | | [-98] | | | | |
| | Config 2 | | [-98] | | | | | [-98] | | | | |
| | Config 3 | | [-98] | | | | | [-98] | | | | |
| SS-RSRP Note 3 | | dBm/SCS | | | | | | | | | | |
| $\hat{E}_s/I_{ot}$ | | | | | | | | | | | | |
| $\hat{E}_s/N_{oc}$ | | | | | | | | | | | | |
| Io | config 1, 2 | dBm/9.36 MHz | | | | | | | | | | |
| | Config 3, 4 | dBm/38.1 MHz | | | | | | | | | | |
| Propagation condition | | | [TDLC300] | | | | | [TDLC300] | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | | | | | | | |

**Table A.4.5.1.4.1-4: Measurement gap configuration for FR1 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

**Table A.4.5.1.4.1-5: NZP-CSI-RS resource configuration for FR1 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation[Note 1] | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.4.5.1.7.1-1 | | |

**Table A.4.5.1.4.1-6: DRX-Configuration for FR1 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode.**

| Field | Test 5 | Test 6 |
|---|---|---|
| | Value | Value |
| drx-onDurationTimer | [ms6] | [ms6] |
| drx-InactivityTimer | [ms1] | [ms1] |
| drx-RetransmissionTimerDL | [sl1] | [sl1] |
| drx-RetransmissionTimerUL | [sl1] | [sl1] |
| longDRX-CycleStartOffset | [ms640] | [ms40] |
| shortDRX | disable | disable |

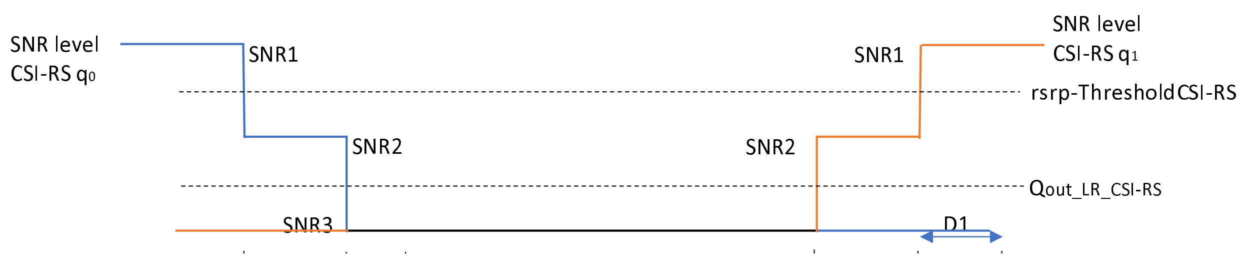


**Figure A.4.5.1.4.1-1: SNR variation SSB for CSI-rs-based beam failure detection and link recovery testing in DRX mode**

### A.4.5.5.4.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_1$.

No later than time point F occurring no later than D1 = [TBD] ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set $q_1$.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

# A.4.5.6 Active BWP switch delay

## A.4.5.6.1 DCI-based and Timer-based Active BWP Switch

### A.4.5.6.1.1 E-UTRAN – NR PSCell FR1 DL active BWP switch in non-DRX in synchronous EN-DC

#### A.4.5.6.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in section 8.6, and interruption requirement for E-UTRA victim cell defined in TS36.133 section 7.32.2.7. Supported test configurations are shown in Table A.4.5.6.1.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in Table A.4.5.6.1.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell is specified in Table A.4.5.6.1.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE is configured with 2 different UE-specific bandwidth parts for PSCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PSCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for PSCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted $i$. The UE shall switch its bandwidth part from BWP-1 to BWP-2.
>
> The UE shall be able to receive PDSCH at PSCell's slot ($i+T_{BWPswitchDelay}$) as defined in section 8.6 and starts to report valid ACK/NACK for the PSCell no later than at slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from slot ($i+T_{BWPswitchDelay}$).
>
> The starting time of PCell(Cell 1) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PSCell(Cell 2).

During T3,

> The time period T3 starts from the slot #$j$ immediately after the slot wherein *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.
>
> The UE shall be able to receive PDSCH at PSCell's slot ($j+T_{BWPswitchDelay}$) as defined in section 8.6 and starts to report valid ACK/NACK for the PSCell at latest at slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from slot ($j+T_{BWPswitchDelay}$).

The starting time of PCell(Cell 1) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PSCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to E-UTRA PCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell during BWP switch of PSCell, respectively.

**Table A.4.5.6.1.1.1-1: DL BWP switch supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations.<br>Note 2: A UE which fulfils the requirements in test case A.4.5.6.1.2 can skip the test cases in A.4.5.6.1.1. | |

**Table A.4.5.6.1.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| E-UTRA RF Channel Number | | 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel Number | | 2 | One NR radio channel is used for this test |
| Active PCell | | Cell 1 | PCell on RF channel number 1. |
| Active PSCell | | Cell 2 | PSCell on RF channel number 2. |
| CP length | | Normal | |
| DRX | | OFF | For both PCell and PSCell |
| *bwp-InactivityTimer* | ms | [200] | |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell2 timing offset to cell1 | µs | 3 | Synchronous EN-DC |
| T1 | s | [0.2] | |
| T2 | s | [0.2] | |
| T3 | s | [0.2] | |

**Table A4.5.6.1.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | | Unit | Cell 2 |
|---|---|---|---|
| Frequency Range | | | FR1 |
| Duplex mode | Config 1,4 | | FDD |
| | Config 2,3,5,6 | | TDD |
| TDD configuration | Config 1,4 | | Not Applicable |
| | Config 2,5 | | TDDConf.1.1 |
| | Config 3,6 | | TDDConf.1.2 |
| $BW_{channel}$ | Config 1,4 | | 10 MHz: $N_{RB,c}$ = 52 |
| | Config 2,5 | | 10 MHz: $N_{RB,c}$ = 52 |
| | Config 3,6 | | 40 MHz: $N_{RB,c}$ = 106 |
| Active BWP ID | | | 1, 2 |
| Initial BWP Configuration | Config 1,4 | | DLBWP.0.2 Note 4 |
| | Config 2,5 | | |
| | Config 3,6 | | |
| Active BWP-1 Configuration | Config 1,4 | | DLBWP.1.1 Note 4 |
| | Config 2,5 | | |
| | Config 3,6 | | |
| Active BWP-2 Configuration | Config 1,4 | | DLBWP.1.3 Note 4 |
| | Config 2,5 | | |
| | Config 3,6 | | |
| PDSCH Reference measurement channel | Config 1,4 | | SR.1.1 FDD |
| | Config 2,5 | | SR.1.1 TDD |
| | Config 3,6 | | SR.2.1 TDD |
| RMSI CORESET parameters | Config 1,4 | | CR.1.1 FDD |
| | Config 2,5 | | CR.1.1 TDD |
| | Config 3,6 | | CR.2.1 TDD |
| Dedicated CORESET parameters | Config 1,4 | | CCR.1.1 FDD |
| | Config 2,5 | | CCR.1.1 TDD |
| | Config 3,6 | | CCR.2.1 TDD |
| OCNG Patterns | | | OP.1 |
| SSB Configuration | Config 1,2,4,5 | | SSB.1 FR1 |
| | Config 3,6 | | SSB.2 FR1 |
| SMTC Configuration | | | SMTC.1 |
| Correlation Matrix and Antenna Configuration | | | 1x2 Low |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | |
| EPRE ratio of PDSCH to PDSCH | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| $N_{oc}$ Note 2 | Config 1,2,4,5 | dBm/SCS | [-104] |
| | Config 3,6 | | [-101] |
| $N_{oc}$ Note 2 | | dBm/15kHz | [-104] |
| SS-RSRP Note 3 | Config 1,2,4,5 | dBm/SCS | [-87] |
| | Config 3,6 | | [-90] |
| $\hat{E}_s/I_{ot}$ | | dB | [17] |
| $\hat{E}_s/N_{oc}$ | | dB | [17] |
| Io Note3 | Config 1,2,4,5 | dBm/ 9.36MHz | [-59] |
| | Config 3,6 | dBm/ 38.16MHz | [-61.9] |
| Propagation Condition | | | AWGN |

| | |
|---|---|
| Note 1: | OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. |
| Note 2: | Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled. |
| Note 3: | SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |
| Note 4: | For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in TS 38.213 [3] section 12. |

#### A.4.5.6.1.1.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell in a slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for PSCell in a slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in Table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1, the start time of PCell interruption during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start time of PCell interruption of during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in TS36.133 Section 7.32.2.7.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in a slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

### A.4.5.6.1.2 E-UTRAN – NR PSCell FR1 DL active BWP switch with FR1 SCell in non-DRX in synchronous EN-DC

#### A.4.5.6.1.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in section 8.6, and interruption requirements for NR victim cell defined in section 8.2.1.2.7 and interruption requirement for E-UTRA victim cell defined in TS36.133 section 7.32.2.7. Supported test configurations are shown in Table A.4.5.6.1.2.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), one NR PSCell (Cell 2) and one NR SCell (Cell 3) as given in Table A.4.5.6.1.2.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and SCell are specified in Table A.4.5.6.1.2.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) and SCell (Cell 3) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), Cell 2 (PSCell) on radio channel 2 (PSCC) and Cell 3 (SCell) on radio channel 3 (SCC).
- UE is configured with 2 different UE-specific bandwidth parts for PSCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is configured with 1 UE-specific bandwidth parts the same as initial BWP for SCell, BWP-0 in Cell 3 before starting the test.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in SCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PSCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for PSCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH at PSCell's slot ($i+T_{BWPswitchDelay}$) as defined in section 8.6 and starts to report valid ACK/NACK for the PSCell no later than at slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from slot ($i+T_{BWPswitchDelay}$).

PCell(Cell 1) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.

SCell(Cell 3) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PSCell(Cell 2).

During T3,

The time period T3 starts from the slot #*j* immediately after the slot wherein *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH at PSCell's slot ($j+T_{BWPswitchDelay}$) as defined in section 8.6 and starts to report valid ACK/NACK for the PSCell at latest at slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from slot ($j+T_{BWPswitchDelay}$).

PCell(Cell 1) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

SCell(Cell 3) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PSCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to E-UTRA PCell and NR SCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell and SCell during BWP switch of PSCell, respectively.

**Table A.4.5.6.1.2.1-1: DL BWP switch supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations<br>Note 2: A UE which fulfils the requirements in test case A.4.5.6.1.2 can skip the test cases in A.4.5.6.1.1.<br>Note 3: NR configuration is the same for PSCell and SCells. | |

**Table A.4.5.6.1.2.1-2: General test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| E-UTRA RF Channel Number | | 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel Number | | 2, 3 | Two NR radio channel is used for this test |
| Active PCell | | Cell 1 | PCell on RF channel number 1. |
| Active PSCell | | Cell 2 | PSCell on RF channel number 2. |
| Active SCell | | Cell 3 | SCell on RF channel number 3. |
| CP length | | Normal | |
| DRX | | OFF | |
| *bwp-InactivityTimer* | ms | [200] | |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell-individual offset for cells on RF channel number 3 | dB | 0 | Individual offset for cells on SCC. |
| Cell2 timing offset to cell1 | µs | 3 | Synchronous EN-DC |
| Cell3 timing offset to cell2 | µs | 3 | Synchronous cells |
| T1 | s | [0.2] | |
| T2 | s | [0.2] | |
| T3 | s | [0.2] | |

**Table A.4.5.6.1.2.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | | Unit | Cell 2 | Cell 3 |
|---|---|---|---|---|
| Frequency Range | | | FR1 | |
| Duplex mode | Config 1,4 | | FDD | |
| | Config 2,3,5,6 | | TDD | |
| TDD configuration | Config 1,4 | | Not Applicable | |
| | Config 2,5 | | TDDConf.1.1 | |
| | Config 3,6 | | TDDConf.1.2 | |
| $BW_{channel}$ | Config 1,4 | | 10 MHz: $N_{RB,c}$ = 52 | |
| | Config 2,5 | | 10 MHz: $N_{RB,c}$ = 52 | |
| | Config 3,6 | | 40 MHz: $N_{RB,c}$ = 106 | |
| Active BWP ID | | | 1, 2 | 0 |
| Initial BWP Configuration | Config 1,4 | | DLBWP.0.2 | DLBWP.0.2 |
| | Config 2,5 | | | |
| | Config 3,6 | | | |
| Active BWP-0 Configuration | Config 1,4 | | NA | DLBWP.0.2 |
| | Config 2,5 | | | |
| | Config 3,6 | | | |
| Active BWP-1 Configuration | Config 1,4 | | DLBWP.1.3 | NA |
| | Config 2,5 | | | |
| | Config 3,6 | | | |
| Active BWP-2 Configuration | Config 1,4 | | DLBWP.1.1 | NA |
| | Config 2,5 | | | |
| | Config 3,6 | | | |
| PDSCH Reference measurement channel | Config 1,4 | | SR.1.1 FDD | |
| | Config 2,5 | | SR.1.1 TDD | |
| | Config 3,6 | | SR2.1 TDD | |
| RMSI CORESET parameters | Config 1,4 | | CR.1.1 FDD | |
| | Config 2,5 | | CR.1.1 TDD | |
| | Config 3,6 | | CR2.1 TDD | |
| Dedicated CORESET parameters | Config 1,4 | | CCR.1.1 FDD | |
| | Config 2,5 | | CCR.1.1 TDD | |
| | Config 3,6 | | CCR.2.1 TDD | |
| OCNG Patterns | | | OP.1 | |
| SSB Configuration | Config 1,2,4,5 | | SSB.1 FR1 | |
| | Config 3,6 | | SSB.2 FR1 | |
| SMTC Configuration | | | SMTC.1 | |
| Antenna Configuration | | | 1x2 | |
| Propagation Condition | | | AWGN | |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | |
| $N_{oc}$ Note 2 | | dBm/15 kHz | [-104] | [-104] |
| SS-RSRP Note 3 | | dBm/15 kHz | [-87] | [-87] |
| $\hat{E}_s/I_{ot}$ | | dB | 17 | 17 |
| $\hat{E}_s/N_{oc}$ | | dB | 17 | 17 |
| Io Note3 | Config 1,2,4,5 | dBm/ 9.36MHz | TBD | TBD |
| | Config 3,6 | dBm/ 38.16MHz | TBD | TBD |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in TS 38.213 [3] section 12. | | | | |

#### A.4.5.6.1.2.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell in a slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for PSCell in a slot ($j+T_{BWPswitchDelay}+k11$).

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1, the start of the interruption of PCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of PCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in TS36.133 Section 7.32.2.7.

During T1, the start of the interruption of SCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of SCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of SCell shall not be longer than the interruption duration specified for active BWP switch in Section 8.6.2.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in a slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

*Editor's note: FFS value of k1 for type 1 and type 2 UE.*

### A.4.5.6.2 RRC-based Active BWP Switch

#### A.4.5.6.2.1 E-UTRAN – NR PSCell FR1 DL active BWP switch in non-DRX in synchronous EN-DC

##### A.4.5.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in section 8.6. Supported test configurations are shown in Table A.4.5.6.2.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1) and one NR PSCell (Cell 2) as given in Table A.4.5.6.2.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell are specified in Table A.4.5.6.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC) and to Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PSCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with bandwidth part configuration BWP-2, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH at PSCell's slot ($i+X$) as defined in section 8.6 and starts to report valid ACK/NACK for the PSCell no later than at slot ($i+X+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from slot ($i+X$).

The test equipment verifies the DL BWP switch time in PSCell by counting the slots from the time when the RRC Reconfiguration message including BWP switch command is received till an ACK is received.

**Table A.4.5.6.2.1.1-1: DL BWP switch supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations | |

**Table A.4.5.6.2.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| E-UTRA RF Channel Number | | 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel Number | | 2 | One NR radio channel is used for this test |
| Active PCell | | Cell 1 | PCell on RF channel number 1. |
| Active PSCell | | Cell 2 | PSCell on RF channel number 2. |
| CP length | | Normal | |
| DRX | | OFF | |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell2 timing offset to cell1 | µs | 3 | Synchronous EN-DC |
| T1 | s | [0.2] | |

**Table A.4.5.6.2.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | | Unit | Cell 2 |
|---|---|---|---|
| Frequency Range | | | FR1 |
| Duplex mode | Config 1,4 | | FDD |
| | Config 2,3,5,6 | | TDD |
| TDD configuration | Config 1,4 | | Not Applicable |
| | Config 2,5 | | TDDConf.1.1 |
| | Config 3,6 | | TDDConf.1.2 |
| $BW_{channel}$ | Config 1,4 | | 10 MHz: $N_{RB,c}$ = 52 |
| | Config 2,5 | | 10 MHz: $N_{RB,c}$ = 52 |
| | Config 3,6 | | 40 MHz: $N_{RB,c}$ = 106 |
| Active BWP ID | | | 1, 2 |
| Initial BWP Configuration | Config 1,4 | | DLBWP.0.2 |
| | Config 2,5 | | |
| | Config 3,6 | | |
| Active BWP-0 Configuration | Config 1,4 | | NA |
| | Config 2,5 | | |
| | Config 3,6 | | |
| Active BWP-1 Configuration | Config 1,4 | | DLBWP.1.3 |
| | Config 2,5 | | |
| | Config 3,6 | | |
| Active BWP-2 Configuration | Config 1,4 | | DLBWP.1.1 |
| | Config 2,5 | | |
| | Config 3,6 | | |
| PDSCH Reference measurement channel | Config 1,4 | | SR.1.1 FDD |
| | Config 2,5 | | SR.1.1 TDD |
| | Config 3,6 | | SR2.1 TDD |
| RMSI CORESET parameters | Config 1,4 | | CR.1.1 FDD |
| | Config 2,5 | | CR.1.1 TDD |
| | Config 3,6 | | CR2.1 TDD |
| Dedicated CORESET parameters | Config 1,4 | | CCR.1.1 FDD |
| | Config 2,5 | | CCR.1.1 TDD |
| | Config 3,6 | | CCR.2.1 TDD |
| OCNG Patterns | | | OP.1 |
| SSB Configuration | Config 1,2,4,5 | | SSB.1 FR1 |
| | Config 3,6 | | SSB.2 FR1 |
| SMTC Configuration | | | SMTC.1 |
| Antenna Configuration | | | 1x2 |
| Propagation Condition | | | AWGN |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | |
| EPRE ratio of PDSCH to PDSCH | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| $N_{oc}$ Note 2 | | dBm/15 kHz | [-104] |
| SS-RSRP Note 3 | | dBm/15 kHz | [-87] |
| $\hat{E}_s/I_{ot}$ | | dB | 17 |
| $\hat{E}_s/N_{oc}$ | | dB | 17 |
| Io Note3 | Config 1,2,4,5 | dBm/ 9.36MHz | TBD |
| | Config 3,6 | dBm/ 38.16MHz | TBD |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in TS 38.213 [3] section 12. | | | |

##### A.4.5.6.2.2.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell in a slot (*i+X+k1*).

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, if there are no uplink resources for reporting the ACK in a slot (*i+X+k1*), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

*Editor's note: FFS value of X, k1 for type 1 and type 2 UE.*

## A.4.6 Measurement procedure

### A.4.6.1 Intra-frequency Measurements

#### A.4.6.1.1 EN-DC event triggered reporting tests without gap under non-DRX

##### A.4.6.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

##### A.4.6.1.1.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters for PSCell are given in Table A.4.6.1.1.2-1, A.4.6.1.1.2-2, A.4.6.1.1.2-3 below and the test parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

**Table A.4.6.1.1.2-1: Supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

**Table A.4.6.1.1.2-2: General test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1**

| Parameter | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|
| Active cell | | 1, 2, 3 | E-UTRAN Cell 1 and NR Cell 2 | |
| Neighbour cell | | 1, 2, 3 | NR Cell 3 | Cell to be identified. |
| RF Channel Number | | 1, 2, 3 | 1: Cell 1<br>2: Cell 2 and Cell 3 | |
| SSB configuration | | 1 | SSB.1 FR1 | |
| | | 2 | SSB.1 FR1 | |
| | | 3 | SSB.2 FR1 | |
| SMTC configuration | | 1 | SMTC pattern 2 | |
| | | 2 | SMTC pattern 1 | |
| | | 3 | SMTC pattern 1 | |
| A3-Offset | dB | 1, 2, 3 | -4.5 | |
| CP length | | 1, 2, 3 | Normal | |
| Hysteresis | dB | 1, 2, 3 | 0 | |
| Time To Trigger | s | 1, 2, 3 | 0 | |
| Filter coefficient | | 1, 2, 3 | 0 | L3 filtering is not used |
| DRX | | 1, 2, 3 | | OFF |
| Time offset between PCell and PSCell | | 1, 2, 3 | 3 μs | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | 1 | 3 ms | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| | | 2 | 3 μs | Synchronous cells |
| | | 3 | 3 μs | Synchronous cells |
| T1 | s | 1, 2, 3 | 5 | |
| T2 | s | 1, 2, 3 | 5 | |

**Table A.4.6.1.1.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1 | N/A | | N/A | |
| | | 2 | TDDConf.1.1 | | TDDConf.1.1 | |
| | | 3 | TDDConf.2.1 | | TDDConf.2.1 | |
| PDSCH RMC configuration | | 1 | SR.1.1 FDD | | N/A | |
| | | 2 | SR.1.1 TDD | | | |
| | | 3 | SR.2.1 TDD | | | |
| RMSI CORESET RMC configuration | | 1 | CR.1.1 FDD | | CR.1.1 FDD | |
| | | 2 | CR.1.1 TDD | | CR.1.1 TDD | |
| | | 3 | CR.2.1 TDD | | CR.2.1 TDD | |
| Dedicated CORESET RMC configuration | | 1 | CCR.1.1 FDD | | CCR.1.1 FDD | |
| | | 2 | CCR.1.1 TDD | | CCR.1.1 TDD | |
| | | 3 | CCR.2.1 TDD | | CCR.2.1 TDD | |
| OCNG Patterns | | 1, 2, 3 | OP.1 | | OP.1 | |
| Intial BWP configuration | | 1, 2, 3 | DLBWP.0 ULBWP.0 | | DLBWP.0 ULBWP.0 | |
| Active DL BWP configuration | | 1, 2, 3 | DLBWP.1 | | DLBWP.1 | |
| Active UL BWP configuration | | 1, 2, 3 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1, 2, 3 | SSB | | SSB | |
| $N_{oc}$ Note 2 | dBm/SCS | 1 | -98 | | | |
| | | 2 | -98 | | | |
| | | 3 | -95 | | | |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1 | -98 | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1 | 4 | -1.46 | -Infinity | -1.46 |
| | | 2 | | | | |
| | | 3 | | | | |
| $\hat{E}_s/N_{oc}$ | dB | 1 | 4 | 4 | -Infinity | 4 |
| | | 2 | | | | |
| | | 3 | | | | |
| SS-RSRP Note 3 | dBm/SCS KHz | 1 | -94 | -94 | -Infinity | -94 |
| | | 2 | -94 | -94 | -Infinity | -94 |
| | | 3 | -91 | -91 | -Infinity | -91 |
| Io | dBm/9.36 MHz | 1 | -64.60 | -62.25 | -Infinity | -62.25 |
| | dBm/9.36 MHz | 2 | -64.60 | -62.25 | -Infinity | -62.25 |
| | dBm/38.16 MHz | 3 | -58.50 | -56.16 | -Infinity | -56.16 |
| Propagation Condition | | 1, 2, 3 | AWGN | | | |

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

### A.4.6.1.1.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [800] ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.4.6.1.2 EN-DC event triggered reporting tests without gap under DRX

#### A.4.6.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

#### A.4.6.1.2.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters for PSCell are given in Table A.4.6.1.2.1-1, A.4.6.1.2.1-2, A.4.6.1.2.1-3 and A.4.6.1.2.1-4 below and the test parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

**Table A.4.6.1.2.2-1: Supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

**Table A.4.6.1.2.2-2: General test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1 with DRX**

| Parameter | Unit | Test configuration | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active cell | | 1, 2, 3 | E-UTRAN Cell 1 and NR Cell 2 | | |
| Neighbour cell | | 1, 2, 3 | NR Cell 3 | | Cell to be identified. |
| RF Channel Number | | 1, 2, 3 | 1: Cell 1<br>2: Cell 2 and Cell 3 | | |
| SSB configuration | | 1 | SSB.1 FR1 | | |
| | | 2 | SSB.1 FR1 | | |
| | | 3 | SSB.2 FR1 | | |
| SMTC configuration | | 1 | SMTC pattern 2 | | |
| | | 2 | SMTC pattern 1 | | |
| | | 3 | SMTC pattern 1 | | |
| A3-Offset | dB | 1, 2, 3 | -4.5 | | |
| CP length | | 1, 2, 3 | Normal | | |
| Hysteresis | dB | 1, 2, 3 | 0 | | |
| Time To Trigger | s | 1, 2, 3 | 0 | | |
| Filter coefficient | | 1, 2, 3 | 0 | | L3 filtering is not used |
| DRX | ms | 1, 2, 3 | 40 | 640 | |
| Time offset between PCell and PSCell | | 1, 2, 3 | 3 μs | | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | 1 | 3 ms | | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| | | 2 | 3 μs | | Synchronous cells |
| | | 3 | 3 μs | | Synchronous cells |
| T1 | s | 1, 2, 3 | 5 | | |
| T2 | s | 1, 2, 3 | 5 | 10 | |

**Table A.4.6.1.2.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1 with DRX**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1 | N/A | | N/A | |
| | | 2 | TDDConf.1.1 | | TDDConf.1.1 | |
| | | 3 | TDDConf.2.1 | | TDDConf.2.1 | |
| PDSCH RMC configuration | | 1 | SR.1.1 FDD | | N/A | |
| | | 2 | SR.1.1 TDD | | | |
| | | 3 | SR.2.1 TDD | | | |
| RMSI CORESET RMC configuration | | 1 | CR.1.1 FDD | | CR.1.1 FDD | |
| | | 2 | CR.1.1 TDD | | CR.1.1 TDD | |
| | | 3 | CR.2.1 TDD | | CR.2.1 TDD | |
| Dedicated CORESET RMC configuration | | 1 | CCR.1.1 FDD | | CCR.1.1 FDD | |
| | | 2 | CCR.1.1 TDD | | CCR.1.1 TDD | |
| | | 3 | CCR.2.1 TDD | | CCR.2.1 TDD | |
| OCNG Patterns | | 1, 2, 3 | OP.1 | | OP.1 | |
| Intial BWP configuration | | 1, 2, 3 | DLBWP.0<br>ULBWP.0 | | DLBWP.0<br>ULBWP.0 | |
| Active DL BWP configuration | | 1, 2, 3 | DLBWP.1 | | DLBWP.1 | |
| Active UL BWP configuration | | 1, 2, 3 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1, 2, 3 | SSB | | SSB | |
| $N_{oc}$ Note 2 | dBm/SCS | 1 | -98 | | | |
| | | 2 | -98 | | | |
| | | 3 | -95 | | | |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1 | -98 | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1 | 4 | -1.46 | -Infinity | -1.46 |
| | | 2 | | | | |
| | | 3 | | | | |
| $\hat{E}_s/N_{oc}$ | dB | 1 | 4 | 4 | -Infinity | 4 |
| | | 2 | | | | |
| | | 3 | | | | |
| SS-RSRP Note 3 | dBm/SCS KHz | 1 | -94 | -94 | -Infinity | -94 |
| | | 2 | -94 | -94 | -Infinity | -94 |
| | | 3 | -91 | -91 | -Infinity | -91 |
| Io | dBm/9.36 MHz | 1 | -64.60 | -62.25 | -Infinity | -62.25 |
| | dBm/9.36 MHz | 2 | -64.60 | -62.25 | -Infinity | -62.25 |
| | dBm/38.16 MHz | 3 | -58.50 | -56.16 | -Infinity | -56.16 |
| Propagation Condition | | 1, 2, 3 | AWGN | | | |

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.

Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

**Table A.4.6.1.2.1-3: DRX-Configuration for EN-DC intra-frequency event triggered reporting with gaps for TDD PSCell in FR1**

| Field | Test1 | Test2 | Comment |
|---|---|---|---|
| | Value | Value | |
| onDurationTimer | psf1 | psf1 | As specified in clause 6.3.2 in TS 38.331 [2] |
| drx-InactivityTimer | psf1 | psf1 | |
| drx-RetransmissionTimer | psf1 | psf1 | |
| longDRX-CycleStartOffset | Sf40 | Sf640 | |
| shortDRX | disable | disable | |

**Table A.4.6.1.2.1-4: *TimeAlignmentTimer* -Configuration for EN-DC intra-frequency event triggered reporting with gaps for TDD PSCell in FR1**

| Field | Test1 | Test2 | Comment |
|---|---|---|---|
| | Value | Value | |
| TimeAlignmentTimer | sf500 | sf500 | As specified in clause 6.3.2 in TS 38.331 [2] |

#### A.4.6.1.2.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [920] ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [6400] ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.4.6.1.3 EN-DC event triggered reporting tests with per-UE gaps under non-DRX

#### A.4.6.1.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

#### A.4.6.1.3.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell.The test parameters for PSCell are given in Table A.4.6.1.3.1-1 and A.4.6.1.3.1-2 below and the test parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

**Table A.4.6.1.3.2-1: Supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

**Table A.4.6.1.3.2-2: General test parameters for EN-DC intra-frequency event triggered reporting with per-UE gaps for PSCell in FR1**

| Parameter | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|
| Active cell | | 1, 2, 3 | E-UTRAN Cell 1 and NR Cell 2 | |
| Neighbour cell | | 1, 2, 3 | NR Cell 3 | Cell to be identified. |
| RF Channel Number | | 1, 2, 3 | 1: Cell 1<br>2: Cell 2 and Cell 3 | |
| Measurement gap type | | 1, 2, 3 | Per-UE gaps | |
| Measurement gap repitition periodicity | ms | 1, 2, 3 | 40 | |
| Measurement gap length | ms | 1, 2, 3 | 6 | |
| Measurement gap offset | ms | 1, 2, 3 | 39 | |
| SSB configuration | | 1 | SSB.1 FR1 | |
| | | 2 | SSB.1 FR1 | |
| | | 3 | SSB.2 FR1 | |
| SMTC configuration | | 1 | SMTC pattern 2 | |
| | | 2 | SMTC pattern 1 | |
| | | 3 | SMTC pattern 1 | |
| CSI-RS parameters | | 1 | TBD | |
| | | 2 | TBD | |
| | | 3 | TBD | |
| A3-Offset | dB | 1, 2, 3 | -4.5 | |
| CP length | | 1, 2, 3 | Normal | |
| Hysteresis | dB | 1, 2, 3 | 0 | |
| Time To Trigger | s | 1, 2, 3 | 0 | |
| Filter coefficient | | 1, 2, 3 | 0 | L3 filtering is not used |
| DRX | ms | 1, 2, 3 | | OFF |
| Time offset between PCell and PSCell | | 1, 2, 3 | 3 μs | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | 1 | 3 ms | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| | | 2 | 3 μs | Synchronous cells |
| | | 3 | 3 μs | Synchronous cells |
| T1 | s | 1, 2, 3 | 5 | |
| T2 | s | 1, 2, 3 | 5 | |

**Table A.4.6.1.3.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting with per-UE gaps for PSCell in FR1**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1 | N/A | | N/A | |
| | | 2 | TDDConf.1.1 | | TDDConf.1.1 | |
| | | 3 | TDDConf.2.1 | | TDDConf.2.1 | |
| PDSCH RMC configuration | | 1 | SR.1.1 FDD | | N/A | |
| | | 2 | SR.1.1 TDD | | | |
| | | 3 | SR.2.1 TDD | | | |
| RMSI CORESET RMC configuration | | 1 | CR.1.1 FDD | | CR.1.1 FDD | |
| | | 2 | CR.1.1 TDD | | CR.1.1 TDD | |
| | | 3 | CR.2.1 TDD | | CR.2.1 TDD | |
| Dedicated CORESET RMC configuration | | 1 | CCR.1.1 FDD | | CCR.1.1 FDD | |
| | | 2 | CCR.1.1 TDD | | CCR.1.1 TDD | |
| | | 3 | CCR.2.1 TDD | | CCR.2.1 TDD | |
| OCNG Patterns | | 1, 2, 3 | OP.1 | | OP.1 | |
| Intial BWP configuration | | 1, 2, 3 | DLBWP.0 ULBWP.0 | | DLBWP.0 ULBWP.0 | |
| Active DL BWP configuration | | 1, 2, 3 | DLBWP.2 | | DLBWP.1 | |
| Active UL BWP configuration | | 1, 2, 3 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1, 2, 3 | CSI-RS | | SSB | |
| $N_{oc}$ Note 2 | dBm/SCS | 1 | -98 | | | |
| | | 2 | -98 | | | |
| | | 3 | -95 | | | |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1 | -98 | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1 | 4 | -1.46 | -Infinity | -1.46 |
| | | 2 | | | | |
| | | 3 | | | | |
| $\hat{E}_s/N_{oc}$ | dB | 1 | 4 | 4 | -Infinity | 4 |
| | | 2 | | | | |
| | | 3 | | | | |
| SS-RSRP Note 3 | dBm/SCS KHz | 1 | -94 | -94 | -Infinity | -94 |
| | | 2 | -94 | -94 | -Infinity | -94 |
| | | 3 | -91 | -91 | -Infinity | -91 |
| Io | dBm/9.36 MHz | 1 | -64.60 | -62.25 | -Infinity | -62.25 |
| | dBm/9.36 MHz | 2 | -64.60 | -62.25 | -Infinity | -62.25 |
| | dBm/38.16 MHz | 3 | -58.50 | -56.16 | -Infinity | -56.16 |
| Propagation Condition | | 1, 2, 3 | AWGN | | | |

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.

Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

## A.4.6.1.3.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

## A.4.6.1.4 EN-DC event triggered reporting tests with per-UE gaps under DRX

### A.4.6.1.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

### A.4.6.1.4.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell.The test parameters for PSCell are given in Table A.4.6.1.4.2-1, A.4.6.1.4.2-2, A.4.6.1.4.2-3 A.4.6.1.4.2-4 and A.4.6.1.4.2-5 below and the test parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

**Table A.4.6.1.4.2-1: Supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

**Table A.4.6.1.4.2-2: General test parameters for EN-DC intra-frequency event triggered reporting with per-UE gaps for PSCell in FR1 with DRX**

| Parameter | Unit | Test configuration | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active cell | | 1, 2, 3 | E-UTRAN Cell 1 and NR Cell 2 | | |
| Neighbour cell | | 1, 2, 3 | NR Cell 3 | | Cell to be identified. |
| RF Channel Number | | 1, 2, 3 | 1: Cell 1<br>2: Cell 2 and Cell 3 | | |
| Measurement gap type | | 1, 2, 3 | Per-UE gaps | | |
| Measurement gap repitition periodicity | ms | 1, 2, 3 | 40 | | |
| Measurement gap length | ms | 1, 2, 3 | 6 | | |
| Measurement gap offset | ms | 1, 2, 3 | 39 | | |
| SSB configuration | | 1 | SSB.1 FR1 | | |
| | | 2 | SSB.1 FR1 | | |
| | | 3 | SSB.2 FR1 | | |
| SMTC configuration | | 1 | SMTC pattern 2 | | |
| | | 2 | SMTC pattern 1 | | |
| | | 3 | SMTC pattern 1 | | |
| CSI-RS parameters | | 1 | TBD | | |
| | | 2 | TBD | | |
| | | 3 | TBD | | |
| A3-Offset | dB | 1, 2, 3 | -4.5 | | |
| CP length | | 1, 2, 3 | Normal | | |
| Hysteresis | dB | 1, 2, 3 | 0 | | |
| Time To Trigger | s | 1, 2, 3 | 0 | | |
| Filter coefficient | | 1, 2, 3 | 0 | | L3 filtering is not used |
| DRX | ms | 1, 2, 3 | 40 | 640 | |
| Time offset between PCell and PSCell | | 1, 2, 3 | 3 µs | | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | 1 | 3 ms | | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| | | 2 | 3 µs | | Synchronous cells |
| | | 3 | 3 µs | | Synchronous cells |
| T1 | s | 1, 2, 3 | 5 | | |
| T2 | s | 1, 2, 3 | 5 | 10 | |

**Table A.4.6.1.4.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting with per-UE gaps for PSCell in FR1 with DRX**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1 | N/A | | N/A | |
| | | 2 | TDDConf.1.1 | | TDDConf.1.1 | |
| | | 3 | TDDConf.2.1 | | TDDConf.2.1 | |
| PDSCH RMC configuration | | 1 | SR.1.1 FDD | | N/A | |
| | | 2 | SR.1.1 TDD | | | |
| | | 3 | SR.2.1 TDD | | | |
| RMSI CORESET RMC configuration | | 1 | CR.1.1 FDD | | CR.1.1 FDD | |
| | | 2 | CR.1.1 TDD | | CR.1.1 TDD | |
| | | 3 | CR.2.1 TDD | | CR.2.1 TDD | |
| Dedicated CORESET RMC configuration | | 1 | CCR.1.1 FDD | | CCR.1.1 FDD | |
| | | 2 | CCR.1.1 TDD | | CCR.1.1 TDD | |
| | | 3 | CCR.2.1 TDD | | CCR.2.1 TDD | |
| OCNG Patterns | | 1, 2, 3 | OP.1 | | OP.1 | |
| Intial BWP configuration | | 1, 2, 3 | DLBWP.0<br>ULBWP.0 | | DLBWP.0<br>ULBWP.0 | |
| Active DL BWP configuration | | 1, 2, 3 | DLBWP.2 | | DLBWP.1 | |
| Active UL BWP configuration | | 1, 2, 3 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1, 2, 3 | CSI-RS | | SSB | |
| $N_{oc}$ Note 2 | dBm/SCS | 1 | -98 | | | |
| | | 2 | -98 | | | |
| | | 3 | -95 | | | |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1 | -98 | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1 | 4 | -1.46 | -Infinity | -1.46 |
| | | 2 | | | | |
| | | 3 | | | | |
| $\hat{E}_s/N_{oc}$ | dB | 1 | 4 | 4 | -Infinity | 4 |
| | | 2 | | | | |
| | | 3 | | | | |
| SS-RSRP Note 3 | dBm/SCS KHz | 1 | -94 | -94 | -Infinity | -94 |
| | | 2 | -94 | -94 | -Infinity | -94 |
| | | 3 | -91 | -91 | -Infinity | -91 |
| Io | dBm/9.36 MHz | 1 | -64.60 | -62.25 | -Infinity | -62.25 |
| | dBm/9.36 MHz | 2 | -64.60 | -62.25 | -Infinity | -62.25 |
| | dBm/38.16 MHz | 3 | -58.50 | -56.16 | -Infinity | -56.16 |
| Propagation Condition | | 1, 2, 3 | AWGN | | | |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | |

**Table A.4.6.1.4.2-4: DRX-Configuration for EN-DC intra-frequency event triggered reporting with gaps for PSCell in FR1**

| Field | Test1 | Test2 | Comment |
|---|---|---|---|
| | Value | Value | |
| onDurationTimer | psf1 | psf1 | As specified in clause 6.3.2 in TS 38.331 [2] |
| drx-InactivityTimer | psf1 | psf1 | |
| drx-RetransmissionTimer | psf1 | psf1 | |
| longDRX-CycleStartOffset | Sf40 | Sf640 | |
| shortDRX | disable | disable | |

**Table A.4.6.1.4.2-5: *TimeAlignmentTimer* -Configuration for EN-DC intra-frequency event triggered reporting with gaps for PSCell in FR1**

| Field | Test1 | Test2 | Comment |
|---|---|---|---|
| | Value | Value | |
| TimeAlignmentTimer | sf500 | sf500 | As specified in clause 6.3.2 in TS 38.331 [2] |

#### A.4.6.1.4.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [920] ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [6400] ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.4.6.1.5 EN-DC event triggered reporting tests without gap under non-DRX with SSB index reading

#### A.4.6.1.5.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the FDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

#### A.4.6.1.5.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell.The test parameters for FDD PSCell are given in Table A.4.6.1.5.1-1 and A.4.6.1.5.1-2 below and the test parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

**Table A.4.6.1.5.2-1: Supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

**Table A.4.6.1.5.2-2: General test parameters for EN-DC intra-frequency event triggered reporting without gap for FDD PSCell in FR1 with SSB index reading**

| Parameter | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|
| Active cell | | 1 | E-UTRAN Cell 1 and NR Cell 2 | |
| Neighbour cell | | 1 | NR Cell 3 | Cell to be identified. |
| RF Channel Number | | 1 | 1: Cell 1<br>2: Cell 2 and Cell 3 | |
| SSB configuration | | 1 | SSB.1 FR1 | |
| SMTC configuration | | 1 | SMTC pattern 2 | |
| A3-Offset | dB | 1 | -4.5 | |
| CP length | | 1 | Normal | |
| Hysteresis | dB | 1 | 0 | |
| Time To Trigger | s | 1 | 0 | |
| Filter coefficient | | 1 | 0 | L3 filtering is not used |
| DRX | ms | 1 | | OFF |
| Time offset between PCell and PSCell | | 1 | 3 μs | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | 1 | 3 ms | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| T1 | s | 1 | 5 | |
| T2 | s | 1 | 5 | |

**Table A.4.6.1.5.1-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting without gap for FDD PSCell in FR1 with SSB index reading**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1 | N/A | | N/A | |
| PDSCH RMC configuration | | 1 | SR.1.1 FDD | | N/A | |
| RMSI CORESET RMC configuration | | 1 | CR.1.1 FDD | | CR.1.1 FDD | |
| Dedicated CORESET RMC configuration | | 1 | CCR.1.1 FDD | | CCR.1.1 FDD | |
| OCNG Patterns | | 1 | OP.1 | | OP.1 | |
| Intial BWP configuration | | 1 | DLBWP.0<br>ULBWP.0 | | DLBWP.0<br>ULBWP.0 | |
| Active DL BWP configuration | | 1 | DLBWP.1 | | DLBWP.1 | |
| Active UL BWP configuration | | 1 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1 | SSB | | SSB | |
| $N_{oc}$ Note 2 | dBm/SCS | 1 | -98 | | | |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1 | -98 | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1 | 4 | -1.46 | -Infinity | -1.46 |
| $\hat{E}_s/N_{oc}$ | dB | 1 | 4 | 4 | -Infinity | 4 |
| SS-RSRP Note 3 | dBm/SCS KHz | 1 | -94 | -94 | -Infinity | -94 |
| Io | dBm/9.36 MHz | 1 | -64.60 | -62.25 | -Infinity | -62.25 |
| Propagation Condition | | 1 | AWGN | | | |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | |

### A.4.6.1.5.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [920] ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

## A.4.6.1.6 EN-DC event triggered reporting tests with SSB index reading with per-UE gaps

### A.4.6.1.6.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

### A.4.6.1.6.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell.The test parameters for PSCell are given in Table A.4.6.1.6.2-1 A.4.6.1.6.2-2 and A.4.6.1.6.2-3 below and the test parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

**Table A.4.6.1.6.2-1: Supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

**Table A.4.6.1.6.2-2: General test parameters for EN-DC intra-frequency event triggered reporting with gap for PSCell in FR1 with SSB index reading**

| Parameter | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|
| Active cell | | 1 | E-UTRAN Cell 1 and NR Cell 2 | |
| Neighbour cell | | 1 | NR Cell 3 | Cell to be identified. |
| RF Channel Number | | 1 | 1: Cell 1<br>2: Cell 2 and Cell 3 | |
| Measurement gap type | | 1 | Per-UE gaps | |
| Measurement gap repitition periodicity | ms | 1 | 40 | |
| Measurement gap length | ms | 1 | 6 | |
| Measurement gap offset | ms | 1 | 39 | |
| SSB configuration | | 1 | SSB.1 FR1 | |
| SMTC configuration | | 1 | SMTC pattern 2 | |
| CSI-RS parameters | | 1 | TBD | |
| A3-Offset | dB | 1 | -4.5 | |
| CP length | | 1 | Normal | |
| Hysteresis | dB | 1 | 0 | |
| Time To Trigger | s | 1 | 0 | |
| Filter coefficient | | 1 | 0 | L3 filtering is not used |
| DRX | ms | 1 | | OFF |
| Time offset between PCell and PSCell | | 1 | 3 μs | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | 1 | 3 ms | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| T1 | s | 1 | 5 | |
| T2 | s | 1 | 5 | |

**Table A.4.6.1.6.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting with gap for PSCell in FR1 with SSB index reading**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1 | N/A | | N/A | |
| PDSCH RMC configuration | | 1 | SR.1.1 FDD | | N/A | |
| RMSI CORESET RMC configuration | | 1 | CR.1.1 FDD | | CR.1.1 FDD | |
| Dedicated CORESET RMC configuration | | 1 | CCR.1.1 FDD | | CCR.1.1 FDD | |
| OCNG Patterns | | 1 | OP.1 | | OP.1 | |
| Intial BWP configuration | | 1 | DLBWP.0 ULBWP.0 | | DLBWP.0 ULBWP.0 | |
| Active DL BWP configuration | | 1 | DLBWP.2 | | DLBWP.1 | |
| Active UL BWP configuration | | 1 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1 | CSI-RS | | SSB | |
| $N_{oc}$ Note 2 | dBm/SCS | 1 | -98 | | | |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1 | -98 | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1 | 4 | -1.46 | -Infinity | -1.46 |
| $\hat{E}_s/N_{oc}$ | dB | 1 | 4 | 4 | -Infinity | 4 |
| SS-RSRP Note 3 | dBm/SCS KHz | 1 | -94 | -94 | -Infinity | -94 |
| Io | dBm/9.36 MHz | 1 | -64.60 | -62.25 | -Infinity | -62.25 |
| Propagation Condition | | 1 | AWGN | | | |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | |

#### A.4.6.1.6.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [920] ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

## A.4.6.2 Inter-frequency Measurements

### A.4.6.2.1 EN-DC event triggered reporting tests for FR1 cell without SSB time index detection when DRX is not used

#### A.4.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in Tables A.4.6.2.1.1-1, A.4.6.2.1.1-2, and A.4.6.2.1.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.4.6.2.1.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #4 as defined in Table A.4.6.2.1.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.1.1-1.

**Table A.4.6.2.1.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations<br>Note 2: target NR cell3 has the same SCS, BW and duplex mode as NR serving cell2 | |

**Table A.4.6.2.1.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection**

| Parameter | Unit | Test configuration | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| E-UTRA RF Channel Number | | Config 1,2,3,4,5,6 | 1 | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number | | Config 1,2,3,4,5,6 | 1, 2 | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1,2,3,4,5,6 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | LTE Cell 1 is on E-UTRA RF channel number 1.<br>NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3,4,5,6 | NR cell 3 | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3,4,5,6 | 0 | 4 | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3,4,5,6 | 39 | 19 | |
| SMTC-SSB parameters | | Config 1,4 | SSB.1 FR1 | | As specified in clause A.3.10.1 |
| | | Config 2,5 | SSB.1 FR1 | | As specified in clause A.3.10.1 |
| | | Config 3,6 | SSB.2 FR1 | | As specified in clause A.3.10.1 |
| A3-Offset | dB | Config 1,2,3,4,5,6 | -6 | | |
| Hysteresis | dB | Config 1,2,3,4,5,6 | 0 | | |
| CP length | | Config 1,2,3,4,5,6 | Normal | | |
| TimeToTrigger | s | Config 1,2,3,4,5,6 | 0 | | |
| Filter coefficient | | Config 1,2,3,4,5,6 | 0 | | L3 filtering is not used |
| DRX | | Config 1,2,3,4,5,6 | OFF | | DRX is not used |
| Time offset between PCell and PSCell | | Config 1,2,3,4,5,6 | 3 µs | | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | Config 1,4 | 3ms | | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| | | Config 2,3,5,6 | 3µs | | Synchronous cells. |
| T1 | s | Config 1,2,3,4,5,6 | 5 | | |
| T2 | s | Config 1,2,3,4,5,6 | TBD | TBD | |

**Table A.4.6.2.1.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | Config 1,2,3,4,5,6 | 1 | | 2 | |
| Duplex mode | | Config 1,4 | FDD | | | |
| | | Config 2,3,5,6 | TDD | | | |
| $BW_{channel}$ | MHz | Config 1,4 | 10: $N_{RB,c}$ = 52 | | | |
| | | Config 2,5 | 10: $N_{RB,c}$ = 52 | | | |
| | | Config 3,6 | 40: $N_{RB,c}$ = 106 | | | |
| BWP BW | MHz | Config 1,4 | 10: $N_{RB,c}$ = 52 | | | |
| | | Config 2,5 | 10: $N_{RB,c}$ = 52 | | | |
| | | Config 3,6 | 40: $N_{RB,c}$ = 106 | | | |
| TDD configuration | | Config 2,5 | TDDConf.1.1 | | TDDConf.1.1 | |
| | | Config 3,6 | TDDConf.2.1 | | TDDConf.2.1 | |
| Initial DL BWP | | Config 1,2,3,4,5,6 | DLBWP.0.1 | | NA | |
| Dedicated DL BWP | | Config 1,2,3,4,5,6 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP | | Config 1,2,3,4,5,6 | ULBWP.1.1 | | NA | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | Config 1,2,3,4,5,6 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | Config 1,4 | SR.1.1 FDD | | - | |
| | | Config 2,5 | SR.1.1 TDD | | | |
| | | Config 3,6 | SR2.1 TDD | | | |
| CORESET Reference Channel | | Config 1,4 | CR.1.1 FDD | | - | |
| | | Config 2,5 | CR.1.1 TDD | | | |
| | | Config 3,6 | CR2.1 TDD | | | |
| SMTC configuration defined in A.3.2.11.1 and A.3.2.11.2 | | Config 1,4 | SMTC.2 | | | |
| | | Config 2,3,5,6 | SMTC.1 | | | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2,4,5 | 15 | | | |
| | | Config 3,6 | 30 | | | |
| EPRE ratio of PSS to SSS | | Config 1,2,3,4,5,6 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| $N_{oc}$ Note2 | dBm/15 kHz | | -98 | | | |
| $N_{oc}$ Note2 | dBm/SCS | Config 1,2,4,5 | -98 | | | |
| | | Config 3,6 | -95 | | | |
| SS-RSRP Note 3 | dBm/SCS | Config 1,2,4,5 | -94 | -94 | -Infinity | -91 |
| | | Config 3,6 | -91 | -91 | -Infinity | -88 |
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2,3,4,5,6 | 4 | 4 | -Infinity | 7 |

| | | | | | | |
|---|---|---|---|---|---|---|
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2,3,4,5,6 | 4 | 4 | -Infinity | 7 |
| Io[Note3] | dBm/9.36MHz | Config 1,2,4,5 | -67.11 | -67.11 | -Infinity | -65.38 |
| | dBm/38.16MHz | Config 3,6 | -62.27 | -62.27 | -Infinity | -61.06 |
| Propagation Condition | | Config 1,2,3,4,5,6 | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | | |

### A.4.6.2.1.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

## A.4.6.2.2 EN-DC event triggered reporting tests for FR1 cell without SSB time index detection when DRX is used

### A.4.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in Tables A.4.6.2.2.1-1, A.4.6.2.2.1-2, and A.4.6.2.2.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.4.6.2.2.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #4 as defined in Table A.4.6.2.2.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.2.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

**Table A.4.6.2.2.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations<br>Note 2: target NR cell3 has the same SCS, BW and duplex mode as NR serving cell2 | |

**Table A.4.6.2.2.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection**

| Parameter | Unit | Test configuration | Value | | | | Comment |
|---|---|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | Test 3 | Test 4 | |
| E-UTRA RF Channel Number | | Config 1,2,3,4,5,6 | 1 | | | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number | | Config 1,2,3,4,5,6 | 1, 2 | | | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1,2,3,4,5,6 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | | | LTE Cell 1 is on E-UTRA RF channel number 1.<br>NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3,4,5,6 | NR cell 3 | | | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3,4,5,6 | 0 | | 4 | | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3,4,5,6 | 39 | | 19 | | |
| SMTC-SSB parameters | | Config 1,4 | SSB.1 FR1 | | | | As specified in clause A.3.10.1 |
| | | Config 2,5 | SSB.1 FR1 | | | | As specified in clause A.3.10.1 |
| | | Config 3,6 | SSB.2 FR1 | | | | As specified in clause A.3.10.1 |
| A3-Offset | dB | Config 1,2,3,4,5,6 | -6 | | | | |
| Hysteresis | dB | Config 1,2,3,4,5,6 | 0 | | | | |
| CP length | | Config 1,2,3,4,5,6 | Normal | | | | |
| TimeToTrigger | s | Config 1,2,3,4,5,6 | 0 | | | | |
| Filter coefficient | | Config 1,2,3,4,5,6 | 0 | | | | L3 filtering is not used |
| DRX | ms | Config 1,2,3,4,5,6 | DRX.1 | DRX.2 | DRX.1 | DRX.2 | DRX is used |
| Time offset between PCell and PSCell | | Config 1,2,3,4,5,6 | 3 µs | | | | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | Config 1,4 | 3ms | | | | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| | | Config 2,3,5,6 | 3µs | | | | Synchronous cells. |
| T1 | s | Config 1,2,3,4,5,6 | 5 | | | | |
| T2 | s | Config 1,2,3,4,5,6 | TBD | TBD | TBD | TBD | |

**Table A.4.6.2.2.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | Config 1,2,3,4,5,6 | 1 | | 2 | |
| Duplex mode | | Config 1,4 | FDD | | | |
| | | Config 2,3,5,6 | TDD | | | |
| $BW_{channel}$ | MHz | Config 1,4 | 10: $N_{RB,c}$ = 52 | | | |
| | | Config 2,5 | 10: $N_{RB,c}$ = 52 | | | |
| | | Config 3,6 | 40: $N_{RB,c}$ = 106 | | | |
| BWP BW | MHz | Config 1,4 | 10: $N_{RB,c}$ = 52 | | | |
| | | Config 2,5 | 10: $N_{RB,c}$ = 52 | | | |
| | | Config 3,6 | 40: $N_{RB,c}$ = 106 | | | |
| TDD configuration | | Config 2,5 | TDDConf.1.1 | | TDDConf.1.1 | |
| | | Config 3,6 | TDDConf.2.1 | | TDDConf.2.1 | |
| Initial DL BWP | | Config 1,2,3,4,5,6 | DLBWP.0.1 | | NA | |
| Dedicated DL BWP | | Config 1,2,3,4,5,6 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP | | Config 1,2,3,4,5,6 | ULBWP.1.1 | | NA | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | Config 1,2,3,4,5,6 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | Config 1,4 | SR.1.1 FDD | | - | |
| | | Config 2,5 | SR.1.1 TDD | | | |
| | | Config 3,6 | SR2.1 TDD | | | |
| CORESET Reference Channel | | Config 1,4 | CR.1.1 FDD | | - | |
| | | Config 2,5 | CR.1.1 TDD | | | |
| | | Config 3,6 | CR2.1 TDD | | | |
| SMTC configuration defined in A.3.11.1 and A.3.11.2 | | Config 1,4 | SMTC.2 | | | |
| | | Config 2,3,5,6 | SMTC.1 | | | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2,4,5 | 15 | | | |
| | | Config 3,6 | 30 | | | |
| EPRE ratio of PSS to SSS | | Config 1,2,3,4,5,6 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| $N_{oc}$ Note2 | dBm/15 kHz | | -98 | | | |
| $N_{oc}$ Note2 | dBm/SCS | Config 1,2,4,5 | -98 | | | |
| | | Config 3,6 | -95 | | | |
| SS-RSRP Note 3 | dBm/SCS | Config 1,2,4,5 | -94 | -94 | -Infinity | -91 |
| | | Config 3,6 | -91 | -91 | -Infinity | -88 |

| | | | | | | |
|---|---|---|---|---|---|---|
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2,3,4,5,6 | 4 | 4 | -Infinity | 7 |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2,3,4,5,6 | 4 | 4 | -Infinity | 7 |
| Io[Note3] | dBm/9.36MHz | Config 1,2,4,5 | -67.11 | -67.11 | -Infinity | -65.38 |
| | dBm/38.16MHz | Config 3,6 | -62.27 | -62.27 | -Infinity | -61.06 |
| Propagation Condition | | Config 1,2,3,4,5,6 | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | | |

#### A.4.6.2.2.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2 , 3 and 4 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2x$TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.4.6.2.3 EN-DC event triggered reporting tests for FR2 cell without SSB time index detection when DRX is not used

#### A.4.6.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2.  The test parameters and configurations are given in Tables A.4.6.2.3.1-1, A.4.6.2.3.1-2, and A.4.6.2.3.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.4.6.2.3.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table A.4.6.2.3.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.3.1-1.

**Table A.4.6.2.3.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR2**

| Config | Description of serving cell | Description of target cell |
|---|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | |
| Note: The UE is only required to be tested in one of the supported test configurations | | |

**Table A.4.6.2.3.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection**

| Parameter | Unit | Test configuration | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| E-UTRA RF Channel Number | | Config 1,2,3,4,5,6 | 1 | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number | | Config 1,2,3,4,5,6 | 1, 2 | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1,2,3,4,5,6 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | LTE Cell 1 is on E-UTRA RF channel number 1.<br>NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3,4,5,6 | NR cell 3 | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3,4,5,6 | 0 | 13 | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3,4,5,6 | 39 | 39 | |
| SMTC-SSB parameters on NR RF Channel 1 | | Config 1,4 | SSB.1 FR1 | | As specified in clause A.3.10.1 |
| | | Config 2,5 | SSB.1 FR1 | | As specified in clause A.3.10.1 |
| | | Config 3,6 | SSB.2 FR1 | | As specified in clause A.3.10.1 |
| SMTC-SSB parameters on NR RF Channel 2 | | Config 1,2,3,4,5,6 | SSB.1 FR2 | | As specified in clause A.3.10.2 |
| *offsetMO* | dB | Config 1,2,3,4,5,6 | 6 | | |
| Hysteresis | dB | Config 1,2,3,4,5,6 | 0 | | |
| *a4-Threshold* | dBm | Config 1,2,3,4,5,6 | TBD | | |
| CP length | | Config 1,2,3,4,5,6 | Normal | | |
| TimeToTrigger | s | Config 1,2,3,4,5,6 | 0 | | |
| Filter coefficient | | Config 1,2,3,4,5,6 | 0 | | L3 filtering is not used |
| DRX | | Config 1,2,3,4,5,6 | OFF | | DRX is not used |
| Time offset between PCell and PSCell | | Config 1,2,3,4,5,6 | 3 µs | | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | Config 1,4 | 3ms | | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| | | Config 2,3,5,6 | 3µs | | Synchronous cells. |
| T1 | s | Config 1,2,3,4,5,6 | 5 | | |
| T2 | s | Config 1,2,3,4,5,6 | TBD | TBD | |

**Table A.4.6.2.3.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | Config 1,2,3,4,5,6 | 1 | | 2 | |
| Duplex mode | | Config 1,4 | FDD | | TDD | |
| | | Config 2,3,5,6 | TDD | | TDD | |
| $BW_{channel}$ | MHz | Config 1,4 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | Config 2,5 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | Config 3,6 | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | MHz | Config 1,4 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | Config 2,5 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | Config 3,6 | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| TDD configuration | | Config 2,5 | TDDConf.1.1 | | TDDConf.3.1 | |
| | | Config 3,6 | TDDConf.2.1 | | TDDConf.3.1 | |
| Initial DL BWP | | Config 1,2,3,4,5,6 | DLBWP.0.1 | | NA | |
| Dedicated DL BWP | | Config 1,2,3,4,5,6 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP | | Config 1,2,3,4,5,6 | ULBWP.1.1 | | NA | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | Config 1,2,3,4,5,6 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | Config 1,4 | SR.1.1 FDD | | - | |
| | | Config 2,5 | SR.1.1 TDD | | | |
| | | Config 3,6 | SR2.1 TDD | | | |
| CORESET Reference Channel | | Config 1,4 | CR.1.1 FDD | | - | |
| | | Config 2,5 | CR.1.1 TDD | | | |
| | | Config 3,6 | CR2.1 TDD | | | |
| SMTC configuration defined in A.3.11.1 and A.3.11.2 | | Config 1,4 | SMTC.2 | | SMTC.2 | |
| | | Config 2,3,5,6 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2,4,5 | 15 | | 120 | |
| | | Config 3,6 | 30 | | 120 | |
| EPRE ratio of PSS to SSS | | Config 1,2,3,4,5,6 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| UE orientation around TBD axis and TBD axis | degrees | Config 1,2,3,4,5,6 | NA | | TBD | |
| Relative difference in angle of arrival of cell 3 relative to cell 2 | degrees | Config 1,2,3,4,5,6 | NA | | NA | TBD |
| $N_{oc}$ Note2 | dBm/15 kHz Note5 | | NA | | TBD | |

| | | | | | | |
|---|---|---|---|---|---|---|
| $N_{oc}$ Note2 | dBm/SCS Note4 | Config 1,2,4,5 | NA | | TBD | |
| | | Config 3,6 | NA | | TBD | |
| SS-RSRP Note 3 | dBm/SCS Note5 | Config 1,2,4,5 | NA | NA | -Infinity | TBD |
| | | Config 3,6 | NA | NA | -Infinity | TBD |
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2,3,4,5,6 | NA | NA | -Infinity | TBD |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2,3,4,5,6 | NA | NA | -Infinity | TBD |
| Io Note3 | dBm/9.36MHz | Config 1,2,4,5 | NA | NA | - | - |
| | dBm/38.16MHz | Config 3,6 | NA | NA | - | - |
| | dBm/95.04 MHz Note5 | Config 1,2,3,4,5,6 | - | - | -Infinity | TBD |
| Propagation Condition | | Config 1,2,3,4,5,6 | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 6: As observed with 0dBi gain antenna at the centre of the quiet zone | | | | | | |

##### A.4.6.2.3.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2x$TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

#### A.4.6.2.4 EN-DC event triggered reporting tests for FR2 cell without SSB time index detection when DRX is used

##### A.4.6.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.4.6.2.4.1-1, A.4.6.2.4.1-2, and A.4.6.2.4.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.4.6.2.4.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table A.4.6.2.4.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.4.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

**Table A.4.6.2.4.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR2**

| Config | Description of serving cell | Description of target cell |
|---|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | |
| Note: The UE is only required to be tested in one of the supported test configurations | | |

**Table A.4.6.2.4.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection**

| Parameter | Unit | Test configuration | Value | | | | Comment |
|---|---|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | Test 3 | Test 4 | |
| E-UTRA RF Channel Number | | Config 1,2,3,4,5,6 | 1 | | | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number | | Config 1,2,3,4,5,6 | 1, 2 | | | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1,2,3,4,5,6 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | | | LTE Cell 1 is on E-UTRA RF channel number 1.<br>NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3,4,5,6 | NR cell 3 | | | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3,4,5,6 | 0 | | 13 | | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3,4,5,6 | 39 | | 39 | | |
| SMTC-SSB parameters on NR RF Channel 1 | | Config 1,4 | SSB.1 FR1 | | | | As specified in clause A.3.10.1 |
| | | Config 2,5 | SSB.1 FR1 | | | | As specified in clause A.3.10.1 |
| | | Config 3,6 | SSB.2 FR1 | | | | As specified in clause A.3.10.1 |
| SMTC-SSB parameters on NR RF Channel 2 | | Config 1,2,3,4,5,6 | SSB.1 FR2 | | | | As specified in clause A.3.10.2 |
| *offsetMO* | dB | Config 1,2,3,4,5,6 | 6 | | | | |
| Hysteresis | dB | Config 1,2,3,4,5,6 | 0 | | | | |
| *a4-Threshold* | dBm | Config 1,2,3,4,5,6 | TBD | | | | |
| CP length | | Config 1,2,3,4,5,6 | Normal | | | | |
| TimeToTrigger | s | Config 1,2,3,4,5,6 | 0 | | | | |
| Filter coefficient | | Config 1,2,3,4,5,6 | 0 | | | | L3 filtering is not used |
| DRX | | Config 1,2,3,4,5,6 | DRX.1 | DRX.2 | DRX.1 | DRX.2 | DRX is used |
| Time offset between PCell and PSCell | | Config 1,2,3,4,5,6 | 3 µs | | | | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | Config 1,4 | 3ms | | | | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| | | Config 2,3,5,6 | 3µs | | | | Synchronous cells. |
| T1 | s | Config 1,2,3,4,5,6 | 5 | | | | |
| T2 | s | Config 1,2,3,4,5,6 | TBD | TBD | TBD | TBD | |

**Table A.4.6.2.4.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | Config 1,2,3,4,5,6 | 1 | | 2 | |
| Duplex mode | | Config 1,4 | FDD | | TDD | |
| | | Config 2,3,5,6 | TDD | | TDD | |
| $BW_{channel}$ | MHz | Config 1,4 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | Config 2,5 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | Config 3,6 | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | MHz | Config 1,4 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | Config 2,5 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | Config 3,6 | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| TDD configuration | | Config 2,5 | TDDConf.1.1 | | TDDConf.3.1 | |
| | | Config 3,6 | TDDConf.2.1 | | TDDConf.3.1 | |
| Initial DL BWP | | Config 1,2,3,4,5,6 | DLBWP.0.1 | | NA | |
| Dedicated DL BWP | | Config 1,2,3,4,5,6 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP | | Config 1,2,3,4,5,6 | ULBWP.1.1 | | NA | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | Config 1,2,3,4,5,6 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | Config 1,4 | SR.1.1 FDD | | - | |
| | | Config 2,5 | SR.1.1 TDD | | | |
| | | Config 3,6 | SR2.1 TDD | | | |
| CORESET Reference Channel | | Config 1,4 | CR.1.1 FDD | | - | |
| | | Config 2,5 | CR.1.1 TDD | | | |
| | | Config 3,6 | CR2.1 TDD | | | |
| SMTC configuration defined in A.3.11.1 and A.3.11.2 | | Config 1,4 | SMTC.2 | | SMTC.2 | |
| | | Config 2,3,5,6 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2,4,5 | 15 | | 120 | |
| | | Config 3,6 | 30 | | 120 | |
| EPRE ratio of PSS to SSS | | Config 1,2,3,4,5,6 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| UE orientation around TBD axis and TBD axis | degrees | Config 1,2,3,4,5,6 | NA | | TBD | |
| Relative difference in angle of arrival of cell 3 relative to cell 2 | degrees | Config 1,2,3,4,5,6 | NA | | NA | TBD |
| $N_{oc}$ Note2 | dBm/15 kHz Note5 | | NA | | TBD | |

| | | | | | | |
|---|---|---|---|---|---|---|
| $N_{oc}$ Note2 | dBm/SCS Note4 | Config 1,2,4,5 | NA | | TBD | |
| | | Config 3,6 | NA | | TBD | |
| SS-RSRP Note 3 | dBm/SCS Note5 | Config 1,2,4,5 | NA | NA | TBD | TBD |
| | | Config 3,6 | NA | NA | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2,3,4,5,6 | NA | NA | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2,3,4,5,6 | NA | NA | TBD | TBD |
| Io Note3 | dBm/9.36MHz | Config 1,2,4,5 | NA | NA | - | - |
| | dBm/38.16MHz | Config 3,6 | NA | NA | - | - |
| | dBm/95.04 MHz Note5 | Config 1,2,3,4,5,6 | - | - | TBD | TBD |
| Propagation Condition | | Config 1,2,3,4,5,6 | AWGN | | | |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 6: As observed with 0dBi gain antenna at the centre of the quiet zone

#### A.4.6.2.4.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-UE gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2 , 3 and 4 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.4.6.2.5 EN-DC event triggered reporting tests for FR1 cell with SSB time index detection when DRX is not used

#### A.4.6.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in Tables A.4.6.2.5.1-1, A.4.6.2.5.1-2, and A.4.6.2.5.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.4.6.2.5.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #4 as defined in Table A.4.6.2.5.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.5.1-1.

**Table A.4.6.2.5.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations<br>Note 2: target NR cell3 has the same SCS, BW and duplex mode as NR serving cell2 | |

**Table A.4.6.2.5.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection**

| Parameter | Unit | Test configuration | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| E-UTRA RF Channel Number | | Config 1,2,3,4,5,6 | 1 | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number | | Config 1,2,3,4,5,6 | 1, 2 | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1,2,3,4,5,6 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | LTE Cell 1 is on E-UTRA RF channel number 1.<br>NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3,4,5,6 | NR cell 3 | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3,4,5,6 | 0 | 4 | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3,4,5,6 | 39 | 19 | |
| SMTC-SSB parameters | | Config 1,4 | SSB.1 FR1 | | As specified in clause A.3.10.1 |
| | | Config 2,5 | SSB.1 FR1 | | As specified in clause A.3.10.1 |
| | | Config 3,6 | SSB.2 FR1 | | As specified in clause A.3.10.1 |
| A3-Offset | dB | Config 1,2,3,4,5,6 | -6 | | |
| Hysteresis | dB | Config 1,2,3,4,5,6 | 0 | | |
| CP length | | Config 1,2,3,4,5,6 | Normal | | |
| TimeToTrigger | s | Config 1,2,3,4,5,6 | 0 | | |
| Filter coefficient | | Config 1,2,3,4,5,6 | 0 | | L3 filtering is not used |
| DRX | | Config 1,2,3,4,5,6 | OFF | | DRX is not used |
| Time offset between PCell and PSCell | | Config 1,2,3,4,5,6 | 3 µs | | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | Config 1,4 | 3ms | | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| | | Config 2,3,5,6 | 3µs | | Synchronous cells. |
| T1 | s | Config 1,2,3,4,5,6 | 5 | | |
| T2 | s | Config 1,2,3,4,5,6 | TBD | TBD | |

**Table A.4.6.2.5.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection**

| Parameter | Unit | Test configuration | Cell 2 T1 | Cell 2 T2 | Cell 3 T1 | Cell 3 T2 |
|---|---|---|---|---|---|---|
| NR RF Channel Number | | Config 1,2,3,4,5,6 | 1 | | 2 | |
| Duplex mode | | Config 1,4 | FDD | | | |
| | | Config 2,3,5,6 | TDD | | | |
| $BW_{channel}$ | MHz | Config 1,4 | 10: $N_{RB,c}$ = 52 | | | |
| | | Config 2,5 | 10: $N_{RB,c}$ = 52 | | | |
| | | Config 3,6 | 40: $N_{RB,c}$ = 106 | | | |
| BWP BW | MHz | Config 1,4 | 10: $N_{RB,c}$ = 52 | | | |
| | | Config 2,5 | 10: $N_{RB,c}$ = 52 | | | |
| | | Config 3,6 | 40: $N_{RB,c}$ = 106 | | | |
| TDD configuration | | Config 2,5 | TDDConf.1.1 | | TDDConf.1.1 | |
| | | Config 3,6 | TDDConf.2.1 | | TDDConf.2.1 | |
| Initial DL BWP | | Config 1,2,3,4,5,6 | DLBWP.0.1 | | NA | |
| Dedicated DL BWP | | Config 1,2,3,4,5,6 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP | | Config 1,2,3,4,5,6 | ULBWP.1.1 | | NA | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | Config 1,2,3,4,5,6 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | Config 1,4 | SR.1.1 FDD | | - | |
| | | Config 2,5 | SR.1.1 TDD | | | |
| | | Config 3,6 | SR2.1 TDD | | | |
| CORESET Reference Channel | | Config 1,4 | CR.1.1 FDD | | - | |
| | | Config 2,5 | CR.1.1 TDD | | | |
| | | Config 3,6 | CR2.1 TDD | | | |
| SMTC configuration defined in A.3.2.11.1 and A.3.2.11.2 | | Config 1,4 | SMTC.2 | | | |
| | | Config 2,3,5,6 | SMTC.1 | | | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2,4,5 | 15 | | | |
| | | Config 3,6 | 30 | | | |
| EPRE ratio of PSS to SSS | | Config 1,2,3,4,5,6 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| $N_{oc}$ Note2 | dBm/15 kHz | | -98 | | | |
| $N_{oc}$ Note2 | dBm/SCS | Config 1,2,4,5 | -98 | | | |
| | | Config 3,6 | -95 | | | |
| SS-RSRP Note 3 | dBm/SCS | Config 1,2,4,5 | -94 | -94 | -Infinity | -91 |
| | | Config 3,6 | -91 | -91 | -Infinity | -88 |

| | | | | | | |
|---|---|---|---|---|---|---|
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2,3,4,5,6 | 4 | 4 | -Infinity | 7 |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2,3,4,5,6 | 4 | 4 | -Infinity | 7 |
| Io Note3 | dBm/9.36MHz | Config 1,2,4,5 | -67.11 | -67.11 | -Infinity | -65.38 |
| | dBm/38.16MHz | Config 3,6 | -62.27 | -62.27 | -Infinity | -61.06 |
| Propagation Condition | | Config 1,2,3,4,5,6 | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | | |

#### A.4.6.2.5.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2xTTI$_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.4.6.2.6 EN-DC event triggered reporting tests for FR1 cell with SSB time index detection when DRX is used

#### A.4.6.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in Tables A.4.6.2.6.1-1, A.4.6.2.6.1-2, and A.4.6.2.6.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.4.6.2.6.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #4 as defined in Table A.4.6.2.6.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.6.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

**Table A.4.6.2.6.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations<br>Note 2: target NR cell3 has the same SCS, BW and duplex mode as NR serving cell2 | |

**Table A.4.6.2.6.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection**

| Parameter | Unit | Test configuration | Value | | | | Comment |
|---|---|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | Test 3 | Test 4 | |
| E-UTRA RF Channel Number | | Config 1,2,3,4,5,6 | 1 | | | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number | | Config 1,2,3,4,5,6 | 1, 2 | | | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1,2,3,4,5,6 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | | | LTE Cell 1 is on E-UTRA RF channel number 1.<br>NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3,4,5,6 | NR cell 3 | | | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3,4,5,6 | 0 | | 4 | | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3,4,5,6 | 39 | | 19 | | |
| SMTC-SSB parameters | | Config 1,4 | SSB.1 FR1 | | | | As specified in clause A.3.10.1 |
| | | Config 2,5 | SSB.1 FR1 | | | | As specified in clause A.3.10.1 |
| | | Config 3,6 | SSB.2 FR1 | | | | As specified in clause A.3.10.1 |
| A3-Offset | dB | Config 1,2,3,4,5,6 | -6 | | | | |
| Hysteresis | dB | Config 1,2,3,4,5,6 | 0 | | | | |
| CP length | | Config 1,2,3,4,5,6 | Normal | | | | |
| TimeToTrigger | s | Config 1,2,3,4,5,6 | 0 | | | | |
| Filter coefficient | | Config 1,2,3,4,5,6 | 0 | | | | L3 filtering is not used |
| DRX | ms | Config 1,2,3,4,5,6 | DRX.1 | DRX.2 | DRX.1 | DRX.2 | DRX is used |
| Time offset between PCell and PSCell | | Config 1,2,3,4,5,6 | 3 μs | | | | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | Config 1,4 | 3ms | | | | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| | | Config 2,3,5,6 | 3μs | | | | Synchronous cells. |
| T1 | s | Config 1,2,3,4,5,6 | 5 | | | | |
| T2 | s | Config 1,2,3,4,5,6 | TBD | TBD | TBD | TBD | |

**Table A.4.6.2.6.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | Config 1,2,3,4,5,6 | 1 | | 2 | |
| Duplex mode | | Config 1,4 | FDD | | | |
| | | Config 2,3,5,6 | TDD | | | |
| $BW_{channel}$ | MHz | Config 1,4 | 10: $N_{RB,c}$ = 52 | | | |
| | | Config 2,5 | 10: $N_{RB,c}$ = 52 | | | |
| | | Config 3,6 | 40: $N_{RB,c}$ = 106 | | | |
| BWP BW | MHz | Config 1,4 | 10: $N_{RB,c}$ = 52 | | | |
| | | Config 2,5 | 10: $N_{RB,c}$ = 52 | | | |
| | | Config 3,6 | 40: $N_{RB,c}$ = 106 | | | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | Config 1,2,3,4,5,6 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | Config 1,4 | SR.1.1 FDD | | - | |
| | | Config 2,5 | SR.1.1 TDD | | | |
| | | Config 3,6 | SR2.1 TDD | | | |
| CORESET Reference Channel | | Config 1,4 | CR.1.1 FDD | | - | |
| | | Config 2,5 | CR.1.1 TDD | | | |
| | | Config 3,6 | CR2.1 TDD | | | |
| TDD configuration | | Config 2,5 | TDDConf.1.1 | | | |
| | | Config 3,6 | TDDConf.2.1 | | | |
| Initial DL BWP | | Config 1,2,3,4,5,6 | DLBWP.0.1 | | | |
| Dedicated DL BWP | | Config 1,2,3,4,5,6 | DLBWP.1.1 | | | |
| Dedicated UL BWP | | Config 1,2,3,4,5,6 | ULBWP.1.1 | | | |
| SMTC configuration defined in A.3.11.1 and A.3.11.2 | | Config 1,4 | SMTC.2 | | | |
| | | Config 2,3,5,6 | SMTC.1 | | | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2,4,5 | 15 | | | |
| | | Config 3,6 | 30 | | | |
| EPRE ratio of PSS to SSS | | Config 1,2,3,4,5,6 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| $N_{oc}$ Note2 | dBm/15 kHz | | -98 | | | |
| $N_{oc}$ Note2 | dBm/SCS | Config 1,2,4,5 | -98 | | | |
| | | Config 3,6 | -95 | | | |
| SS-RSRP Note 3 | dBm/SCS | Config 1,2,4,5 | -94 | -94 | -Infinity | -91 |
| | | Config 3,6 | -91 | -91 | -Infinity | -88 |

| | | | | | | |
|---|---|---|---|---|---|---|
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2,3,4,5,6 | 4 | 4 | -Infinity | 7 |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2,3,4,5,6 | 4 | 4 | -Infinity | 7 |
| Io[Note3] | dBm/9.36MHz | Config 1,2,4,5 | -67.11 | -67.11 | -Infinity | -65.38 |
| | dBm/38.16MHz | Config 3,6 | -62.27 | -62.27 | -Infinity | -61.06 |
| Propagation Condition | | Config 1,2,3,4,5,6 | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | | |

#### A.4.6.2.6.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2 , 3 and 4 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.4.6.2.7 EN-DC event triggered reporting tests for FR2 cell with SSB time index detection when DRX is not used

#### A.4.6.2.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.4.6.2.7.1-1, A.4.6.2.7.1-2, and A.4.6.2.7.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.4.6.2.7.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table A.4.6.2.7.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.7.1-1.

**Table A.4.6.2.7.1-1: EN-DC event triggered reporting tests with SSB index reading for FR1-FR2**

| Config | Description of serving cell | Description of target cell |
|---|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | |
| Note: The UE is only required to be tested in one of the supported test configurations | | |

**Table A.4.6.2.7.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection**

| Parameter | Unit | Test configuration | Value Test 1 | Value Test 2 | Comment |
|---|---|---|---|---|---|
| E-UTRA RF Channel Number | | Config 1,2,3,4,5,6 | 1 | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number | | Config 1,2,3,4,5,6 | 1, 2 | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1,2,3,4,5,6 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | LTE Cell 1 is on E-UTRA RF channel number 1.<br>NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3,4,5,6 | NR cell 3 | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3,4,5,6 | 0 | 13 | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3,4,5,6 | 39 | 39 | |
| SMTC-SSB parameters on NR RF Channel 1 | | Config 1,4 | SSB.1 FR1 | | As specified in clause A.3.10.1 |
| | | Config 2,5 | SSB.1 FR1 | | As specified in clause A.3.10.1 |
| | | Config 3,6 | SSB.2 FR1 | | As specified in clause A.3.10.1 |
| SMTC-SSB parameters on NR RF Channel 2 | | Config 1,2,3,4,5,6 | SSB.1 FR2 | | As specified in clause A.3.10.2 |
| *offsetMO* | dB | Config 1,2,3,4,5,6 | 6 | | |
| Hysteresis | dB | Config 1,2,3,4,5,6 | 0 | | |
| *a4-Threshold* | dBm | Config 1,2,3,4,5,6 | TBD | | |
| CP length | | Config 1,2,3,4,5,6 | Normal | | |
| TimeToTrigger | s | Config 1,2,3,4,5,6 | 0 | | |
| Filter coefficient | | Config 1,2,3,4,5,6 | 0 | | L3 filtering is not used |
| DRX | | Config 1,2,3,4,5,6 | OFF | | DRX is not used |
| Time offset between PCell and PSCell | | Config 1,2,3,4,5,6 | 3 µs | | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | Config 1,4 | 3ms | | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| | | Config 2,3,5,6 | 3µs | | Synchronous cells. |
| T1 | s | Config 1,2,3,4,5,6 | 5 | | |
| T2 | s | Config 1,2,3,4,5,6 | TBD | TBD | |

**Table A.4.6.2.7.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | Config 1,2,3,4,5,6 | 1 | | 2 | |
| Duplex mode | | Config 1,4 | FDD | | TDD | |
| | | Config 2,3,5,6 | TDD | | TDD | |
| $BW_{channel}$ | MHz | Config 1,4 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | Config 2,5 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | Config 3,6 | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | MHz | Config 1,4 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | Config 2,5 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | Config 3,6 | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | Config 1,2,3,4,5,6 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | Config 1,4 | SR.1.1 FDD | | - | |
| | | Config 2,5 | SR.1.1 TDD | | | |
| | | Config 3,6 | SR2.1 TDD | | | |
| CORESET Reference Channel | | Config 1,4 | CR.1.1 FDD | | - | |
| | | Config 2,5 | CR.1.1 TDD | | | |
| | | Config 3,6 | CR2.1 TDD | | | |
| TDD configuration | | Config 2,5 | TDDConf.1.1 | | TDDConf.3.1 | |
| | | Config 3,6 | TDDConf.2.1 | | TDDConf.3.1 | |
| Initial DL BWP | | Config 1,2,3,4,5,6 | DLBWP.0.1 | | NA | |
| Dedicated DL BWP | | Config 1,2,3,4,5,6 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP | | Config 1,2,3,4,5,6 | ULBWP.1.1 | | NA | |
| SMTC configuration defined in A.3.11.1 and A.3.11.2 | | Config 1,4 | SMTC.2 | | SMTC.2 | |
| | | Config 2,3,5,6 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2,4,5 | 15 | | 120 | |
| | | Config 3,6 | 30 | | 120 | |
| EPRE ratio of PSS to SSS | | Config 1,2,3,4,5,6 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| UE orientation around TBD axis and TBD axis | degrees | Config 1,2,3,4,5,6 | NA | | TBD | |
| Relative difference in angle of arrival of cell 3 relative to cell 2 | degrees | Config 1,2,3,4,5,6 | NA | | NA | TBD |
| $N_{oc}$ Note2 | dBm/15 kHz Note5 | | NA | | TBD | |

| | | | | | | |
|---|---|---|---|---|---|---|
| $N_{oc}$ Note2 | dBm/SCS Note4 | Config 1,2,4,5 | NA | | TBD | |
| | | Config 3,6 | NA | | TBD | |
| SS-RSRP Note 3 | dBm/SCS Note5 | Config 1,2,4,5 | NA | NA | -Infinity | TBD |
| | | Config 3,6 | NA | NA | -Infinity | TBD |
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2,3,4,5,6 | NA | NA | -Infinity | TBD |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2,3,4,5,6 | NA | NA | -Infinity | TBD |
| Io Note3 | dBm/9.36MHz | Config 1,2,4,5 | NA | NA | - | - |
| | dBm/38.16MHz | Config 3,6 | NA | NA | - | - |
| | dBm/95.04 MHz Note5 | Config 1,2,3,4,5,6 | - | - | -Infinity | TBD |
| Propagation Condition | | Config 1,2,3,4,5,6 | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 6: As observed with 0dBi gain antenna at the centre of the quiet zone | | | | | | |

#### A.4.6.2.7.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2x$TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.4.6.2.8 EN-DC event triggered reporting tests for FR2 cell with SSB time index detection when DRX is used

#### A.4.6.2.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.4.6.2.8.1-1, A.4.6.2.8.1-2, and A.4.6.2.8.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.4.6.2.8.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table A.4.6.2.8.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.8.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

**Table A.4.6.2.8.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR2**

| Config | Description of serving cell | Description of target cell |
|---|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | |
| Note: The UE is only required to be tested in one of the supported test configurations | | |

**Table A.4.6.2.8.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection**

| Parameter | Unit | Test configuration | Value | | | | Comment |
|---|---|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | Test 3 | Test 4 | |
| E-UTRA RF Channel Number | | Config 1,2,3,4,5,6 | 1 | | | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number | | Config 1,2,3,4,5,6 | 1, 2 | | | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1,2,3,4,5,6 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | | | LTE Cell 1 is on E-UTRA RF channel number 1.<br>NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3,4,5,6 | NR cell 3 | | | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3,4,5,6 | 0 | | 13 | | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3,4,5,6 | 39 | | 39 | | |
| SMTC-SSB parameters on NR RF Channel 1 | | Config 1,4 | SSB.1 FR1 | | | | As specified in clause A.3.10.1 |
| | | Config 2,5 | SSB.1 FR1 | | | | As specified in clause A.3.10.1 |
| | | Config 3,6 | SSB.2 FR1 | | | | As specified in clause A.3.10.1 |
| SMTC-SSB parameters on NR RF Channel 2 | | Config 1,2,3,4,5,6 | SSB.1 FR2 | | | | As specified in clause A.3.10.2 |
| *offsetMO* | dB | Config 1,2,3,4,5,6 | 6 | | | | |
| Hysteresis | dB | Config 1,2,3,4,5,6 | 0 | | | | |
| *a4-Threshold* | dBm | Config 1,2,3,4,5,6 | TBD | | | | |
| CP length | | Config 1,2,3,4,5,6 | Normal | | | | |
| TimeToTrigger | s | Config 1,2,3,4,5,6 | 0 | | | | |
| Filter coefficient | | Config 1,2,3,4,5,6 | 0 | | | | L3 filtering is not used |
| DRX | | Config 1,2,3,4,5,6 | DRX.1 | DRX.2 | DRX.1 | DRX.2 | DRX is used |
| Time offset between PCell and PSCell | | Config 1,2,3,4,5,6 | 3 µs | | | | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | Config 1,4 | 3ms | | | | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| | | Config 2,3,5,6 | 3µs | | | | Synchronous cells. |
| T1 | s | Config 1,2,3,4,5,6 | 5 | | | | |
| T2 | s | Config 1,2,3,4,5,6 | TBD | TBD | TBD | TBD | |

**Table A.4.6.2.8.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | Config 1,2,3,4,5,6 | 1 | | 2 | |
| Duplex mode | | Config 1,4 | FDD | | TDD | |
| | | Config 2,3,5,6 | TDD | | TDD | |
| $BW_{channel}$ | MHz | Config 1,4 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | Config 2,5 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | Config 3,6 | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | MHz | Config 1,4 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | Config 2,5 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | Config 3,6 | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | Config 1,2,3,4,5,6 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | Config 1,4 | SR.1.1 FDD | | - | |
| | | Config 2,5 | SR.1.1 TDD | | | |
| | | Config 3,6 | SR2.1 TDD | | | |
| CORESET Reference Channel | | Config 1,4 | CR.1.1 FDD | | - | |
| | | Config 2,5 | CR.1.1 TDD | | | |
| | | Config 3,6 | CR2.1 TDD | | | |
| TDD configuration | | Config 2,5 | TDDConf.1.1 | | TDDConf.3.1 | |
| | | Config 3,6 | TDDConf.2.1 | | TDDConf.3.1 | |
| Initial DL BWP | | Config 1,2,3,4,5,6 | DLBWP.0.1 | | NA | |
| Dedicated DL BWP | | Config 1,2,3,4,5,6 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP | | Config 1,2,3,4,5,6 | ULBWP.1.1 | | NA | |
| SMTC configuration defined in A.3.11.1 and A.3.11.2 | | Config 1,4 | SMTC.2 | | SMTC.2 | |
| | | Config 2,3,5,6 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2,4,5 | 15 | | 120 | |
| | | Config 3,6 | 30 | | 120 | |
| EPRE ratio of PSS to SSS | | Config 1,2,3,4,5,6 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| UE orientation around TBD axis and TBD axis | degrees | Config 1,2,3,4,5,6 | NA | | TBD | |
| Relative difference in angle of arrival of cell 3 relative to cell 2 | degrees | Config 1,2,3,4,5,6 | NA | | NA | TBD |
| $N_{oc}$ Note2 | dBm/15 kHz Note5 | | NA | | TBD | |

| | | | | | | |
|---|---|---|---|---|---|---|
| $N_{oc}$ Note2 | dBm/SCS Note4 | Config 1,2,4,5 | NA | | TBD | |
| | | Config 3,6 | NA | | TBD | |
| SS-RSRP Note 3 | dBm/SCS Note5 | Config 1,2,4,5 | NA | NA | TBD | TBD |
| | | Config 3,6 | NA | NA | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2,3,4,5,6 | NA | NA | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2,3,4,5,6 | NA | NA | TBD | TBD |
| Io Note3 | dBm/9.36MHz | Config 1,2,4,5 | NA | NA | - | - |
| | dBm/38.16MHz | Config 3,6 | NA | NA | - | - |
| | dBm/95.04 MHz Note5 | Config 1,2,3,4,5,6 | - | - | TBD | TBD |
| Propagation Condition | | Config 1,2,3,4,5,6 | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 6: As observed with 0dBi gain antenna at the centre of the quiet zone | | | | | | |

### A.4.6.2.8.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-UE gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2 , 3 and 4 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

# A.4.7 Measurement Performance requirements

## A.4.7.1 SS-RSRP

### A.4.7.1.1 intra-frequency case

#### A.4.7.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 10.1.2.1.1and 10.1.2.1.2 for intra frequency measurements.

#### A.4.7.1.1.2 Test parameters

In this set of test cases all NR cells are on the same carrier frequency. Supported test configurations are shown in table A.4.7.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra frequency measurements are tested by using the parameters in A.4.7.1.1.2-2. The configuration of cell 1 (E-UTRA PCell) is specified in section A.3.7.2.1 In all test cases, Cell 2 is the PSCell, and Cell 3 the target cell.

**Table A.4.7.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations**

| Config | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.4.7.1.1.2-2: SS-RSRP Intra frequency test parameters**

| Parameter | | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|---|
| | | | Cell 2 | Cell 3 | Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| SSB ARFCN | | | freq1 | | freq1 | | freq1 | |
| Duplex mode | Config 1,4 | | FDD | | | | | |
| | Config 2,3,5,6 | | TDD | | | | | |
| TDD configuration | Config 1,4 | | Not Applicable | | | | | |
| | Config 2,5 | | TDDConf.1.1 | | | | | |
| | Config 3,6 | | TDDConf.2.1 | | | | | |
| $BW_{channel}$ | Config 1,4 | MHz | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 2,5 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 3,6 | | 40: $N_{RB,c}$ = 106 | | | | | |
| Downlink initial BWP configuration | | | DLBWP.0 | | | | | |
| Downlink dedicated BWP configuration | | | DLBWP.1 | | | | | |
| Uplink dedicated BWP configuration | | | ULBWP.1 | | | | | |
| DRX Cycle | | ms | Not Applicable | | | | | |
| PDSCH Reference measurement channel | Config 1,4 | | SR.1.1 FDD | - | SR.1.1 FDD | - | SR.1.1 FDD | - |
| | Config 2,5 | | SR.1.1 TDD | | SR.1.1 TDD | | SR.1.1 TDD | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Config 3,6 | | SR2.1 TDD | | SR2.1 TDD | | SR2.1 TDD | |
| RMSI CORESET Reference Channel | | Config 1,4 | | CR.1.1 FDD | - | CR.1.1 FDD | - | CR.1.1 FDD | - |
| | | Config 2,5 | | CR.1.1 TDD | | CR.1.1 TDD | | CR.1.1 TDD | |
| | | Config 3,6 | | CR2.1 TDD | | CR2.1 TDD | | CR2.1 TDD | |
| Control Channel RMC | | Config 1,4 | | CCR.1. 1 FDD | - | CCR.1. 1 FDD | - | CCR.1. 1 FDD | - |
| | | Config 2,5 | | CCR.1. 1 TDD | | CCR.1. 1 TDD | | CCR.1. 1 TDD | |
| | | Config 3,6 | | CCR2.1 TDD | | CCR2. 1 TDD | | CCR2.1 TDD | |
| SSB configuration | | Config 1,4 | | SSB 1.FR1 | - | SSB 1.FR1 | - | SSB 1.FR1 | - |
| | | Config 2,5 | | SSB 1.FR1 | | SSB 1.FR1 | | SSB 1.FR1 | |
| | | Config 3,6 | | SSB 2.FR1 | | SSB 2.FR1 | | SSB 2.FR1 | |
| SMTC configuration | | | | SMTC.1 | | | | | |
| OCNG Patterns | | | | OP.1 | | | | | |
| PDSCH/PDCCH subcarrier spacing | | Config 1,2,4,5 | kHz | 15 kHz | | | | | |
| | | Config 3,6 | | 30kHz | | | | | |
| EPRE ratio of PSS to SSS<br>EPRE ratio of PBCH DMRS to SSS<br>EPRE ratio of PBCH to PBCH DMRS<br>EPRE ratio of PDCCH DMRS to SSS<br>EPRE ratio of PDCCH to PDCCH DMRS<br>EPRE ratio of PDSCH DMRS to SSS<br>EPRE ratio of PDSCH to PDSCH<br>EPRE ratio of OCNG DMRS to SSS(Note 1)<br>EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | dB | 0 | 0 | 0 | 0 | 0 | 0 |
| $N_{oc}$ Note2 | Config 1,2,4,5 | NR_FDD_FR1_A, NR_TDD_FR1_A | dBm/15KhZ | -106 | | -88 | | -116 | |
| | | NR_FDD_FR1_B | | | | | | -115.5 | |
| | | NR_TDD_FR1_C | | | | | | -115 | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | -114.5 | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | -114 | |
| | | NR_FDD_FR1_G | | | | | | -113 | |
| | | NR_FDD_FR1_H | | | | | | -112.5 | |
| | Config 3,6 | NR_FDD_FR1_A, NR_TDD_FR1_A | | -113 | | -94 | | -116 | |
| | | NR_FDD_FR1_B | | | | | | -115.5 | |
| | | NR_TDD_FR1_C | | | | | | -115 | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | -114.5 | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | -114 | |
| | | NR_FDD_FR1_G | | | | | | -113 | |
| | | NR_FDD_FR1_H | | | | | | -112.5 | |
| $N_{oc}$ Note2 | Config 1,2,4,5 | | dBm/SCS | -106 | | -88 | | Same as Noc/15kHz | |
| | Config 3,6 | NR_FDD_FR1_A, NR_TDD_FR1_A | | -110 | | -91 | | -113 | |
| | | NR_FDD_FR1_B | | | | | | -112.5 | |
| | | NR_TDD_FR1_C | | | | | | -112 | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | -111.5 | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | -111 | |
| | | NR_FDD_FR1_G | | | | | | -110 | |
| | | NR_FDD_FR1_H | | | | | | -109.5 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $\hat{E}_s/I_{ot}$ | | | dB | 2.5 | -6 | 2.5 | -6 | 0.46 | -5.76 |
| $\hat{E}_s/N_{oc}$ | | | dB | 6 | 1 | 6 | 1 | 3 | -1 |
| SS-RSRP Note3 | Config 1,2,4,5 | NR_FDD_FR1_A, NR_TDD_FR1_A | dBm/SCS | -100 | -105 | -82 | -87 | -113 | -117 |
| | | NR_FDD_FR1_B | | | | | | -112.5 | -116.5 |
| | | NR_TDD_FR1_C | | | | | | -112 | -116 |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | -111.5 | -115.5 |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | -111 | -115 |
| | | NR_FDD_FR1_G | | | | | | -110 | -114 |
| | | NR_FDD_FR1_H | | | | | | -109.5 | -113.5 |
| | Config 3,6 | NR_FDD_FR1_A, NR_TDD_FR1_A | | -106 | -109 | -85 | -90 | -110 | -114 |
| | | NR_FDD_FR1_B | | | | | | -109.5 | -113.5 |
| | | NR_TDD_FR1_C | | | | | | 109 | -113 |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | -108.55 | -112.5 |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | -108 | -112 |
| | | NR_FDD_FR1_G | | | | | | -107 | -111 |
| | | NR_FDD_FR1_H | | | | | | -106.5 | -110.5 |
| Io Note3 | Config 1,2,4,5 | NR_FDD_FR1_A, NR_TDD_FR1_A | dBm/ 9.36MHz | -70.09 | | -52.09 | | -82.26 | |
| | | NR_FDD_FR1_B | | | | | | -81.76 | |
| | | NR_TDD_FR1_C | | | | | | -81.26 | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | -80.76 | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | -80.26 | |
| | | NR_FDD_FR1_G | | | | | | -79.26 | |
| | | NR_FDD_FR1_H | | | | | | -78.76 | |
| | Config 3,6 | NR_FDD_FR1_A, NR_TDD_FR1_A | dBm/ 38.16MHz | -70.99 | | -51.99 | | -76.16 | |
| | | NR_FDD_FR1_B | | | | | | -75.66 | |
| | | NR_TDD_FR1_C | | | | | | -75.16 | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | -74.66 | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | -74.16 | |
| | | NR_FDD_FR1_G | | | | | | -73.16 | |
| | | NR_FDD_FR1_H | | | | | | -72.66 | |
| Propagation condition | | | - | AWGN | | | | | |
| Antenna configuration | | | | 1x2 | | | | | |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

### A.4.7.1.1.3 Test Requirements

The SS-RSRP measurement accuracy for cell 1 and cell 2 shall fulfil absolute requirement in section 10.1.2.1.1 and relative requirement in section 10.1.2.1.2.

### A.4.7.1.2 EN-DC inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

#### A.4.7.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 10.1.4.1.1 and 10.1.4.1.2 for inter-frequency measurements with the testing configurations in Table A.4.7.1.2.1-1.

**Table A.4.7.1.2.1-1: Applicable NR configurations for FR1 inter-frequency SS-RSRP accuracy test**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

#### A.4.7.1.2.2 Test parameters

In this set of test cases there are three cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on a different frequency than the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in Table A.4.7.1.2.2-1 below. Both absolute and relative accuracy of RSRP intra frequency measurements are tested by using the parameters in Table A.4.7.1.2.2-1. The inter frequency measurements are supported by a measurement gap.

**Table A.4.7.1.2.2-1: SS-RSRP inter-frequency test parameters**

| Parameter | Config | Unit | Test 1 | | Test 2 | |
|---|---|---|---|---|---|---|
| | | | Cell 2 | Cell 3 | Cell 2 | Cell 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SSB ARFCN | | 1~6 | | freq1 | freq2 | freq1 | freq2 |
| $BW_{channel}$ | | 1,4 | MHz | 10: $N_{RB,c}$ = 52 | | 10: $N_{RB,c}$ = 52 | |
| | | 2,5 | | 10: $N_{RB,c}$ = 52 | | 10: $N_{RB,c}$ = 52 | |
| | | 3,6 | | 40: $N_{RB,c}$ = 106 | | 40: $N_{RB,c}$ = 106 | |
| Duplex mode | | 1,4 | | FDD | | FDD | |
| | | 2,5 | | TDD | | TDD | |
| | | 3,6 | | TDD | | TDD | |
| TDD configuration | | 1,4 | | N/A | | N/A | |
| | | 2,5 | | TDDConf.1.1 | | TDDConf.1.1 | |
| | | 3,6 | | TDDConf.2.1 | | TDDConf.2.1 | |
| PDSCH Reference measurement channel | | 1,4 | | SR.1.1 FDD | - | SR.1.1 FDD | - |
| | | 2,5 | | SR.1.1 TDD | | SR.1.1 TDD | |
| | | 3,6 | | SR.2.1 FDD | | SR.2.1 FDD | |
| RMSI CORESET Reference Channel | | 1,4 | | CR.1.1 FDD | - | CR.1.1 FDD | - |
| | | 2,5 | | CR.1.1 TDD | - | CR.1.1 TDD | - |
| | | 3,6 | | CR.2.1 FDD | - | CR.2.1 FDD | - |
| Dedicated CORESET Reference Channel | | 1,4 | | CCR.1.1 FDD | - | CCR.1.1 FDD | - |
| | | 2,5 | | CCR.1.1 TDD | - | CCR.1.1 TDD | - |
| | | 3,6 | | CCR.2.1 TDD | - | CCR.2.1 TDD | - |
| SSB configuration | | 1,4 | | SSB.1 FR1 | | SSB.1 FR1 | |
| | | 2,5 | | SSB.1 FR1 | | SSB.1 FR1 | |
| | | 3,6 | | SSB.2 FR1 | | SSB.2 FR1 | |
| OCNG Patterns | | 1~6 | | OP.1 | | OP.1 | |
| DL BWP | | 1~6 | | DLBWP.1.1 | | DLBWP.1.1 | |
| UL BWP | | 1~6 | | ULBWP.1.1 | | ULBWP.1.1 | |
| SMTC configuration | | 1~6 | | SMTC.1 | | SMTC.1 | |
| EPRE ratio of PSS to SSS | | 1~6 | dB | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS Note 1 | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 | | | | | | | |
| $N_{oc}$ Note2 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1~6 | dBm/15 kHz | -94.65 | | TBD | TBD |
| | NR_FDD_FR1_B | | | | | | TBD |
| | NR_TDD_FR1_C | | | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | TBD |
| | NR_FDD_FR1_G | | | | | | TBD |
| | NR_FDD_FR1_H | | | | | | TBD |
| $N_{oc}$ Note2 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2,4,5 | dBm/SSB SCS | -94.65 | | TBD | TBD |
| | NR_FDD_FR1_B | | | | | | TBD |
| | NR_TDD_FR1_C | | | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | TBD |
| | NR_FDD_FR1_G | | | | | | TBD |
| | NR_FDD_FR1_H | | | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3,6 | | -91.65 | | TBD | TBD |
| | NR_FDD_FR1_B | | | | | | TBD |
| | NR_TDD_FR1_C | | | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | TBD |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | TBD |
| | NR_FDD_FR1_G | | | | | | TBD |
| | NR_FDD_FR1_H | | | | | | TBD |
| $\hat{E}_s/I_{ot}$ | | 1~6 | dB | 10 | 10 | TBD | TBD |
| SS-RSRP[Note3] | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2,4,5 | dBm/SCS | -84.65 | | TBD | TBD |
| | NR_FDD_FR1_B | | | | | | TBD |
| | NR_TDD_FR1_C | | | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | TBD |
| | NR_FDD_FR1_G | | | | | | TBD |
| | NR_FDD_FR1_H | | | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3,6 | | -81.65 | | TBD | TBD |
| | NR_FDD_FR1_B | | | | | | TBD |
| | NR_TDD_FR1_C | | | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | TBD |
| | NR_FDD_FR1_G | | | | | | TBD |
| | NR_FDD_FR1_H | | | | | | TBD |
| Io[Note3] | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2,4,5 | dBm/9.36MHz | -56.28 | | TBD | |
| | NR_FDD_FR1_B | | | | | TBD | |
| | NR_TDD_FR1_C | | | | | TBD | |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | TBD | |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | TBD | |
| | NR_FDD_FR1_G | | | | | TBD | |
| | NR_FDD_FR1_H | | | | | TBD | |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3,6 | dBm/38.16MHz | -50.19 | | TBD | |
| | NR_FDD_FR1_B | | | | | TBD | |
| | NR_TDD_FR1_C | | | | | TBD | |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | TBD | |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | TBD | |
| | NR_FDD_FR1_G | | | | | TBD | |
| | NR_FDD_FR1_H | | | | | TBD | |
| $\hat{E}_s/N_{oc}$ | | 1~6 | dB | 10 | 10 | TBD | TBD |
| Propagation condition | | 1~6 | - | AWGN | | AWGN | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | | | |

#### A.4.7.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 and Cell 3 shall fulfil the Absolute requirement in section 10.1.4.1.1 and Relative requirement in section 10.1.4.1.2.

### A.4.7.1.3 EN-DC inter-frequency measurement accuracy with FR1 serving cell and FR2 target cell

#### A.4.7.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 10.1.5.1.1 for inter-frequency measurements with the testing configurations in Table A.4.7.1.3.1-1.

**Table A.4.7.1.3.1-1: Applicable NR configurations for FR1 inter-frequency SS-RSRP accuracy test**

| Config | Description of serving cell | Description of target cell |
|---|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | |
| Note: The UE is only required to be tested in one of the supported test configurations | | |

#### A.4.7.1.3.2 Test parameters

In this set of test cases there are three cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on a different frequency than the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in Table A.4.7.1.3.2-1 and Table A.4.7.1.3.2-2 below. Both absolute and relative accuracy of RSRP intra frequency measurements are tested by using the parameters in Table A.4.7.1.3.2-1 and Table A.4.7.1.3.2-2. The inter frequency measurements are supported by a measurement gap.

**Table A.4.7.1.3.2-1: SS-RSRP inter-frequency test parameters**

| Parameter | Config | Unit | Test 1 | | Test 2 | |
|---|---|---|---|---|---|---|
| | | | Cell 2 | Cell 3 | Cell 2 | Cell 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| SSB ARFCN | 1~6 | | freq1 | freq2 | freq1 | freq2 |
| $BW_{channel}$ | 1,4 | MHz | 10: $N_{RB,c}$ = 52 | 100: $N_{RB,c}$ = 66 | 10: $N_{RB,c}$ = 52 | 100: $N_{RB,c}$ = 66 |
| | 2,5 | | 10: $N_{RB,c}$ = 52 | | 10: $N_{RB,c}$ = 52 | |
| | 3,6 | | 40: $N_{RB,c}$ = 106 | | 40: $N_{RB,c}$ = 106 | |
| Duplex mode | 1,4 | | FDD | TDD | FDD | TDD |
| | 2,5 | | TDD | | TDD | |
| | 3,6 | | TDD | | TDD | |
| TDD configuration | 1,4 | | N/A | TDDConf. 3.1 | N/A | TDDConf. 3.1 |
| | 2,5 | | TDDConf. 1.1 | | TDDConf. 1.1 | |
| | 3,6 | | TDDConf. 2.1 | | TDDConf. 2.1 | |
| PDSCH Reference measurement channel | 1,4 | | SR.1.1 FDD | - | SR.1.1 FDD | - |
| | 2,5 | | SR.1.1 TDD | | SR.1.1 TDD | |
| | 3,6 | | SR.2.1 FDD | | SR.2.1 FDD | |
| RMSI CORESET Reference Channel | 1,4 | | CR.1.1 FDD | - | CR.1.1 FDD | - |
| | 2,5 | | CR.1.1 TDD | - | CR.1.1 TDD | - |
| | 3,6 | | CR.2.1 FDD | - | CR.2.1 FDD | - |
| Dedicated CORESET Reference Channel | 1,4 | | CCR.1.1 FDD | - | CCR.1.1 FDD | - |
| | 2,5 | | CCR.1.1 TDD | - | CCR.1.1 TDD | - |
| | 3,6 | | CCR.2.1 TDD | - | CCR.2.1 TDD | - |
| SSB configuration | 1,4 | | SSB.1 FR1 | SSB.1 FR2 | SSB.1 FR1 | SSB.1 FR2 |
| | 2,5 | | SSB.1 FR1 | | SSB.1 FR1 | |
| | 3,6 | | SSB.2 FR1 | | SSB.2 FR1 | |
| OCNG Patterns | 1~6 | | OP.1 | | OP.1 | |
| DL BWP | 1~6 | | DLBWP.1.1 | | DLBWP.1.1 | |
| UL BWP | 1~6 | | ULBWP.1.1 | | ULBWP.1.1 | |
| SMTC configuration | 1~6 | | SMTC.1 | | SMTC.1 | |
| EPRE ratio of PSS to SSS | 1~6 | dB | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | | | | | |
| EPRE ratio of OCNG DMRS to SSS[Note 1] | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS [Note 1] | | | | | | |
| Propagation condition | 1~6 | - | AWGN | | AWGN | |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.

**Table A.4.7.1.3.2-2: SS-RSRP inter-frequency OTA related test parameters**

| Parameter | | Config | Unit | Test 1 | | Test 2 | |
|---|---|---|---|---|---|---|---|
| | | | | Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| $N_{oc}$ Note2 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1~6 | dBm/15 kHz | TBD | | TBD | TBD |
| | NR_FDD_FR1_B | | | | | | TBD |
| | NR_TDD_FR1_C | | | | | | TBD |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | TBD |
| | NR_FDD_FR1_G | | | | | | TBD |
| | NR_FDD_FR1_H | | | | | | TBD |
| $N_{oc}$ Note2 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2,4,5 | dBm/SSB SCS | TBD | N/A | TBD | TBD |
| | NR_FDD_FR1_B | | | | | | TBD |
| | NR_TDD_FR1_C | | | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | TBD |
| | NR_FDD_FR1_G | | | | | | TBD |
| | NR_FDD_FR1_H | | | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3,6 | | TBD | | TBD | TBD |
| | NR_FDD_FR1_B | | | | | | TBD |
| | NR_TDD_FR1_C | | | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | TBD |
| | NR_FDD_FR1_G | | | | | | TBD |
| | NR_FDD_FR1_H | | | | | | TBD |
| $\hat{E}_s/I_{ot}$ | | 1~6 | dB | TBD | TBD | TBD | TBD |
| SS-RSRP[Note3] | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2,4,5 | dBm/SCS | TBD | TBD | TBD | TBD |
| | NR_FDD_FR1_B | | | | | | TBD |
| | NR_TDD_FR1_C | | | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | TBD |
| | NR_FDD_FR1_G | | | | | | TBD |
| | NR_FDD_FR1_H | | | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3,6 | | TBD | | TBD | TBD |
| | NR_FDD_FR1_B | | | | | | TBD |
| | NR_TDD_FR1_C | | | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | TBD |
| | NR_FDD_FR1_G | | | | | | TBD |
| | NR_FDD_FR1_H | | | | | | TBD |
| Io[Note3] | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2,4,5 | dBm/9.36MHz | N/A | TBD | TBD | |
| | NR_FDD_FR1_B | | | | | TBD | |
| | NR_TDD_FR1_C | | | | | TBD | |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | TBD | |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | TBD | |
| | NR_FDD_FR1_G | | | | | TBD | |
| | NR_FDD_FR1_H | | | | | TBD | |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3,6 | dBm/38.16MHz | N/A | | TBD | |
| | NR_FDD_FR1_B | | | | | TBD | |
| | NR_TDD_FR1_C | | | | | TBD | |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | TBD | |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | TBD | |
| | NR_FDD_FR1_G | | | | | TBD | |
| | NR_FDD_FR1_H | | | | | TBD | |
| | NR_TDD_FR2_A | 1~6 | dBm/95.04MHz | N/A | TBD | N/A | TBD |
| | NR_TDD_FR2_B | | | | | | TBD |
| | NR_TDD_FR2_F | | | | | | TBD |
| | NR_TDD_FR2_G | | | | | | TBD |
| | NR_TDD_FR2_T | | | | | | TBD |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | NR_TDD_FR2_Y | | | | | | TBD |
| $\hat{E}_s/N_{oc}$ | | 1~6 | dB | TBD | TBD | TBD | TBD |
| Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | | | |

#### A.4.7.1.3.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 3 shall fulfil the Absolute requirement in section 10.1.5.1.1.

## A.4.7.2 SS-RSRQ

### A.4.7.2.1 Intra-frequency case

#### A.4.7.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.7.1.1.

#### A.4.7.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in Table A.4.7.2.1.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is test by using the parameters in Table A.4.7.2.1.2-2. The configuration of cell 1 (E-UTRA PCell) is specified in section A.3.7.2.1. In all test cases, Cell 2 is the PSCell and Cell 3 is the target cell.

**Table A.4.7.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.4.7.2.1.2-2: SS-RSRQ Intra frequency test parameters**

| Parameter | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|
| | | Cell 2 | Cell 3 | Cell 2 | Cell 3 | Cell 2 | Cell 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SSB ARFCN | | | freq1 | | freq1 | | freq1 | |
| Duplex mode | Config 1,4 | | FDD | | | | | |
| | Config 2,3,5,6 | | TDD | | | | | |
| TDD configuration | Config 1,4 | | Not Applicable | | | | | |
| | Config 2,5 | | TDDConf.1.1 | | | | | |
| | Config 3,6 | | TDDConf.1.2 | | | | | |
| $BW_{channel}$ | Config 1,4 | MHz | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 2,5 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 3,6 | | 40: $N_{RB,c}$ = 106 | | | | | |
| BWP BW | Config 1,4 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 2,5 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 3,6 | | 40: $N_{RB,c}$ = 106 | | | | | |
| DRx Cycle | | ms | Not Applicable | | | | | |
| PDSCH Reference measurement channel | Config 1,4 | | SR.1.1 FDD | - | SR.1.1 FDD | - | SR.1.1 FDD | - |
| | Config 2,5 | | SR.1.1 TDD | | SR.1.1 TDD | | SR.1.1 TDD | |
| | Config 3,6 | | SR2.1 TDD | | SR2.1 TDD | | SR2.1 TDD | |
| RMSI CORESET Reference Channel | Config 1,4 | | CR.1.1 FDD | - | CR.1.1 FDD | - | CR.1.1 FDD | |
| | Config 2,5 | | CR.1.1 TDD | | CR.1.1 TDD | | CR.1.1 TDD | |
| | Config 3,6 | | CR2.1 TDD | | CR2.1 TDD | | CR2.1 TDD | |
| Dedicated CORESET Reference Channel | Config 1,4 | | CCR.1.1 FDD | - | CCR.1.1 FDD | - | CCR.1.1 FDD | - |
| | Config 2,5 | | CCR.1.1 TDD | | CCR.1.1 TDD | | CCR.1.1 TDD | |
| | Config 3,6 | | CCR2.1 TDD | | CCR2.1 TDD | | CCR2.1 TDD | |
| OCNG Patterns | | | OP. 1 | | | | | |
| SS-RSSI-Measurement | | | Not Applicable | | | | | |
| STMC configuration | | | SMTC.1 | | | | | |
| SSB configuration | Config 1,2,4,5 | | SSB.1 FR1 | | | | | |
| | Config 3,6 | | SSB.2 FR1 | | | | | |
| PDSCH/PDCCH subcarrier spacing | Config 1,2,4,5 | kHz | 15 kHz | | | | | |
| | Config 3,6 | | 30kHz | | | | | |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | | |
| $N_{oc}$ Note2 | NR_FDD_FR1_A, NR_TDD_FR1_A | dBm/15kHz | -91 | | [-110.05] | | [-120] | |
| | NR_FDD_FR1_B | | | | | | [-119.5] | |
| | NR_TDD_FR1_C | | | | | | [-119] | |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | [-118.5] | |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | [-118] | |
| | NR_FDD_FR1_G | | | | | | [-117] | |
| | NR_FDD_FR1_H | | | | | | [-116.5] | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $N_{oc}$ Note2 | Config 1,2,4,5 | | dBm/SCS | -91 | | [-110.05] | | Same as Noc for 15kHz | |
| | Config 3,6 | NR_FDD_FR1_A, NR_TDD_FR1_A | | -88 | | [-107.05] | | [-117] | |
| | | NR_FDD_FR1_B | | | | | | [-116.5] | |
| | | NR_TDD_FR1_C | | | | | | [-116] | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | [-115.5] | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | [-115] | |
| | | NR_FDD_FR1_G | | | | | | [-114] | |
| | | NR_FDD_FR1_H | | | | | | [-113.5] | |
| $\hat{E}_s/I_{ot}$ | | | dB | -1.76 | | -4.7 | | -5.46 | -5.46 |
| $\hat{E}_s/N_{oc}$ | | | dB | 3 | 3 | -2.9 | -2.9 | -4 | -4 |
| SS-RSRP Note3 | Config 1,2,4,5 | NR_FDD_FR1_A, NR_TDD_FR1_A | dBm/SCS | -88 | -88 | [-112.95] | [-112.95] | [-124] | [-124] |
| | | NR_FDD_FR1_B | | | | | | [-123.5] | [-123.5] |
| | | NR_TDD_FR1_C | | | | | | [-123] | [-123] |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | [-122.5] | [-122.5] |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | [-122] | [-122] |
| | | NR_FDD_FR1_G | | | | | | [-121] | [-121] |
| | | NR_FDD_FR1_H | | | | | | [-120.5] | [-120.5] |
| | Config 3,6 | NR_FDD_FR1_A, NR_TDD_FR1_A | | -85 | -85 | [-109.95] | [-109.95] | [-121] | [-121] |
| | | NR_FDD_FR1_B | | | | | | [-120.5] | [-120.5] |
| | | NR_TDD_FR1_C | | | | | | [-120] | [-120] |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | [-119.5] | [-119.5] |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | [-119] | [-119] |
| | | NR_FDD_FR1_G | | | | | | [-118] | [-118] |
| | | NR_FDD_FR1_H | | | | | | [-117.5] | [-117.5] |
| SS-RSRQ Note3 | | NR_FDD_FR1_A, NR_TDD_FR1_A | dB | -14.77 | -14.77 | -16.76 | -16.76 | [-17.34] | [-17.34] |
| | | NR_FDD_FR1_B | | | | | | | |
| | | NR_TDD_FR1_C | | | | | | | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | | |
| | | NR_FDD_FR1_G | | | | | | | |
| | | NR_FDD_FR1_H | | | | | | | |
| Io Note3 | Config 1,2,4,5 | NR_FDD_FR1_A, NR_TDD_FR1_A | dBm/ 9.36MHz | -56 | | [-79] | | [-89.5] | |
| | | NR_FDD_FR1_B | | | | | | [-89] | |
| | | NR_TDD_FR1_C | | | | | | [-88.5] | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | [-88] | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | [-87.5] | |
| | | NR_FDD_FR1_G | | | | | | [-86.5] | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | NR_FDD_FR1_H | | | | | | [-86] | |
| | Config 3,6 | NR_FDD_FR1_A, NR_TDD_FR1_A | dBm/ 38.16MHz | -50.00 | | [-73] | | [-83.41] | |
| | | NR_FDD_FR1_B | | | | | | [-82.91] | |
| | | NR_TDD_FR1_C | | | | | | [-82.41] | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | [-81.91] | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | [81.41] | |
| | | NR_FDD_FR1_G | | | | | | [80.41] | |
| | | NR_FDD_FR1_H | | | | | | [-79.91] | |
| Propagation condition | | | - | AWGN | AWGN | AWGN | AWGN | AWGN | AWGN |
| Antenna configuration | | | | 1x2 | 1x2 | 1x2 | 1x2 | 1x2 | 1x2 |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: NR operating band groups are as defined in Section 3.5.2.

#### A.4.7.2.1.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in section 10.1.7.1.1.

### A.4.7.2.2 EN-DC Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

#### A.4.7.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.9.1.1 and 10.1.9.1.2 for inter frequency measurement.

#### A.4.7.2.2.2 Test Parameters

In this test case the two NR cells (i.e., Cell 2 and Cell 3) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in Table A.4.7.2.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test parameters in Table A.4.7.2.2.2-2. In all test cases, Cell 2 is the PSCell and Cell 3 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in Table A.3.7.2.1-1.

**Table A.4.7.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.4.7.2.2.2-1: SS-RSRQ Inter frequency test parameters**

| Parameter | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|
| | | Cell 2 | Cell 3 | Cell 2 | Cell 3 | Cell 2 | Cell 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SSB ARFCN | | | freq1 | freq2 | freq1 | freq2 | freq1 | freq2 |
| Duplex mode | Config 1,4 | | FDD | | | | | |
| | Config 2,3,5,6 | | TDD | | | | | |
| TDD configuration | Config 1,4 | | Not Applicable | | | | | |
| | Config 2,5 | | TDDConf.1.1 | | | | | |
| | Config 3,6 | | TDDConf.2.1 | | | | | |
| $BW_{channel}$ | Config 1,4 | MHz | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 2,5 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 3,6 | | 40: $N_{RB,c}$ = 106 | | | | | |
| BWP BW | Config 1,4 | MHz | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 2,5 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 3,6 | | 40: $N_{RB,c}$ = 106 | | | | | |
| DRX Cycle | | ms | Not Applicable | | | | | |
| PDSCH Reference measurement channel | Config 1,4 | | SR.1.1 FDD | - | SR.1.1 FDD | - | SR.1.1 FDD | - |
| | Config 2,5 | | SR.1.1 TDD | | SR.1.1 TDD | | SR.1.1 TDD | |
| | Config 3,6 | | SR.2.1 TDD | | SR.2.1 TDD | | SR.2.1 TDD | |
| RMSI CORESET Reference Channel | Config 1,4 | | CR.1.1 FDD | - | CR.1.1 FDD | - | CR.1.1 FDD | - |
| | Config 2,5 | | CR.1.1 TDD | | CR.1.1 TDD | | CR.1.1 TDD | |
| | Config 3,6 | | CR.2.1 TDD | | CR.2.1 TDD | | CR.2.1 TDD | |
| Dedicated CORESET Reference Channel | Config 1,4 | | CCR.1.1 FDD | - | CCR.1.1 FDD | - | CCR.1.1 FDD | - |
| | Config 2,5 | | CCR.1.1 TDD | | CCR.1.1 TDD | | CCR.1.1 TDD | |
| | Config 3,6 | | CCR.2.1 TDD | | CCR.2.1 TDD | | CCR.2.1 TDD | |
| OCNG Patterns | | | OCNG pattern 1 | | | | | |
| SMTC configuration | Config 1,2,4,5 | | SMTC pattern 1 | | | | | |
| | Config 3,6 | | SMTC pattern 2 | | | | | |
| SSB configuration | Config 1,2,4,5 | | SSB pattern 1 in FR1 | | | | | |
| | Config 3,6 | | SSB pattern 2 in FR1 | | | | | |
| PDSCH/PDCCH subcarrier spacing | Config 1,2,4,5 | kHz | 15 kHz | | | | | |
| | Config 3,6 | | 30 kHz | | | | | |
| EPRE ratio of PSS to SSS<br>EPRE ratio of PBCH DMRS to SSS<br>EPRE ratio of PBCH to PBCH DMRS<br>EPRE ratio of PDCCH DMRS to SSS<br>EPRE ratio of PDCCH to PDCCH DMRS<br>EPRE ratio of PDSCH DMRS to SSS<br>EPRE ratio of PDSCH to PDSCH<br>EPRE ratio of OCNG DMRS to SSS(Note 1)<br>EPRE ratio of OCNG to OCNG DMRS (Note 1) | | dB | 0 | 0 | 0 | 0 | 0 | 0 |
| $N_{oc}$ Note2 | Config 1,2,4,5: NR_FDD_FR1_A<br>NR_TDD_FR1_A | dBm/15kHz | -80.18 | | TBD | | TBD | |
| | NR_FDD_FR1_B | | | | | | TBD | |
| | NR_TDD_FR1_C | | | | | | TBD | |
| | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | | TBD | |
| | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | | TBD | |
| | NR_FDD_FR1_G | | | | | | TBD | |
| | NR_FDD_FR1_H | | | | | | TBD | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $N_{oc}$ Note2 | Config 3,6 | NR_FDD_FR1_A<br>NR_TDD_FR1_A | dBm/15kHz | -86.27 | | | | | |
| | | NR_FDD_FR1_B | | | | | | | |
| | | NR_TDD_FR1_C | | | | | | | |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | | | |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | | | |
| | | NR_FDD_FR1_G | | | | | | | |
| | | NR_FDD_FR1_H | | | | | | | |
| $N_{oc}$ Note2 | Config 1,2,4,5 | NR_FDD_FR1_A<br>NR_TDD_FR1_A | dBm/SCS | -80.18 | | TBD | | TBD | |
| | | NR_FDD_FR1_B | | | | | | TBD | |
| | | NR_TDD_FR1_C | | | | | | TBD | |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | | TBD | |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | | TBD | |
| | | NR_FDD_FR1_G | | | | | | TBD | |
| | | NR_FDD_FR1_H | | | | | | TBD | |
| | Config 3,6 | NR_FDD_FR1_A<br>NR_TDD_FR1_A | | -83.27 | | TBD | | TBD | |
| | | NR_FDD_FR1_B | | | | | | TBD | |
| | | NR_TDD_FR1_C | | | | | | TBD | |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | | TBD | |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | | TBD | |
| | | NR_FDD_FR1_G | | | | | | TBD | |
| | | NR_FDD_FR1_H | | | | | | TBD | |
| $\hat{E}_s/I_{ot}$ | | | dB | -1.75 | | TBD | | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | | | dB | -1.75 | | TBD | | TBD | TBD |
| SS-RSRP Note3 | Config 1,2,4,5 | NR_FDD_FR1_A<br>NR_TDD_FR1_A | dBm/SCS | -81.93 | -81.93 | TBD | TBD | TBD | TBD |
| | | NR_FDD_FR1_B | | | | | | TBD | TBD |
| | | NR_TDD_FR1_C | | | | | | TBD | TBD |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | | TBD | TBD |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | | TBD | TBD |
| | | NR_FDD_FR1_G | | | | | | TBD | TBD |
| | | NR_FDD_FR1_H | | | | | | TBD | TBD |
| | Config 3,6 | NR_FDD_FR1_A<br>NR_TDD_FR1_A | | -85.02 | -85.02 | TBD | TBD | TBD | TBD |
| | | NR_FDD_FR1_B | | | | | | TBD | TBD |
| | | NR_TDD_FR1_C | | | | | | TBD | TBD |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | | TBD | TBD |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | | TBD | TBD |
| | | NR_FDD_FR1_G | | | | | | TBD | TBD |
| | | NR_FDD_FR1_H | | | | | | TBD | TBD |
| SS-RSRQ Note3 | | NR_FDD_FR1_A<br>NR_TDD_FR1_A | dB | -14.77 | -14.77 | TBD | TBD | TBD | TBD |
| | | NR_FDD_FR1_B | | | | | | TBD | TBD |
| | | NR_TDD_FR1_C | | | | | | TBD | TBD |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | | TBD | TBD |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | | TBD | TBD |
| | | NR_FDD_FR1_G | | | | | | TBD | TBD |
| | | NR_FDD_FR1_H | | | | | | TBD | TBD |
| Io Note3 | Config 1,2,4,5 | NR_FDD_FR1_A<br>NR_TDD_FR1_A | dBm/9.36MHz | -50 | | TBD | | TBD | |
| | | NR_FDD_FR1_B | | | | | | TBD | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | NR_TDD_FR1_C | | | | | | TBD | |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | | TBD | |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | | TBD | |
| | | NR_FDD_FR1_G | | | | | | TBD | |
| | | NR_FDD_FR1_H | | | | | | TBD | |
| | Config 3,6 | NR_FDD_FR1_A<br>NR_TDD_FR1_A | dBm/<br>38.16MHz | -50 | | TBD | | TBD | |
| | | NR_FDD_FR1_B | | | | | | TBD | |
| | | NR_TDD_FR1_C | | | | | | TBD | |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | | TBD | |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | | TBD | |
| | | NR_FDD_FR1_G | | | | | | TBD | |
| | | NR_FDD_FR1_H | | | | | | TBD | |
| Propagation condition | | | - | AWGN | AWGN | AWGN | AWGN | AWGN | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 5: NR operating band groups are as defined in Section 3.5.2. | | | | | | | | | |

##### A.4.7.2.2.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in section 10.1.9.1.1 and 10.1.9.1.2.

### A.4.7.3 SS-SINR

### A.4.7.4 L1-RSRP measurement for beam reporting

#### A.4.7.4.1 SSB based L1-RSRP measurement

##### A.4.7.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 9.5.2 and section 10.1.19.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in Table A.4.7.4.1.1-1.

**Table A.4.7.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

##### A.4.7.4.1.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.7.4.1.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in Table A.4.7.4.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0 and 1.

**Table A.4.7.4.1.2-1: FR1 SSB based L1-RSRP test parameters**

| Parameter | | Config | Unit | Test 1 | Test 2 |
|---|---|---|---|---|---|
| SSB GSCN | | 1~6 | | freq1 | freq1 |
| Duplex mode | | 1,4 | | FDD | FDD |
| | | 2,5 | | TDD | TDD |
| | | 3,6 | | TDD | TDD |
| TDD Configuration | | 1,4 | | N/A | N/A |
| | | 2,5 | | TDDConf.1.1 | TDDConf.1.1 |
| | | 3,6 | | TDDConf.2.1 | TDDConf.2.1 |
| $BW_{channel}$ | | 1,4 | MHz | 10: $N_{RB,c}$ = 52 | 10: $N_{RB,c}$ = 52 |
| | | 2,5 | | 10: $N_{RB,c}$ = 52 | 10: $N_{RB,c}$ = 52 |
| | | 3,6 | | 40: $N_{RB,c}$ = 106 | 40: $N_{RB,c}$ = 106 |
| PDSCH Reference measurement channel | | 1,4 | | SR.1.1 FDD | SR.1.1 FDD |
| | | 2,5 | | SR.1.1 TDD | SR.1.1 TDD |
| | | 3,6 | | SR.2.1 TDD | SR.2.1 TDD |
| RMSI CORESET Reference Channel | | 1,4 | | CR.1.1 FDD | CR.1.1 FDD |
| | | 2,5 | | CR.1.1 TDD | CR.1.1 TDD |
| | | 3,6 | | CR.2.1 TDD | CR.2.1 TDD |
| Dedicated CORESET Reference Channel | | 1,4 | | CCR.1.1 FDD | CCR.1.1 FDD |
| | | 2,5 | | CCR.1.1 TDD | CCR.1.1 TDD |
| | | 3,6 | | CCR.2.1 TDD | CCR.2.1 TDD |
| SSB configuration | | 1,4 | | SSB.3 FR1 | SSB.3 FR1 |
| | | 2,5 | | SSB.3 FR1 | SSB.3 FR1 |
| | | 3,6 | | SSB.4 FR1 | SSB.4 FR1 |
| OCNG Patterns | | 1~6 | | OP.1 | OP.1 |
| DL BWP | | 1~6 | | DLBWP.1.1 | DLBWP.1.1 |
| UL BWP | | 1~6 | | ULBWP.1.1 | ULBWP.1.1 |
| SMTC configuration | | 1~6 | | SMTC.1 | SMTC.1 |
| Number of reported RS | | 1~6 | | 2 | 2 |
| L1-RSRP reporting period | | 1~6 | | TBD | TBD |
| EPRE ratio of PSS to SSS | | 1~6 | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | | | | |
| EPRE ratio of OCNG DMRS to SSS Note 1 | | | | | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 | | | | | |
| $N_{oc}$ Note2 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1~6 | dBm/15kHz | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| $N_{oc}$ Note2 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2,4,5 | dBm/SSB SCS | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |

| | | | | | |
|---|---|---|---|---|---|
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3,6 | | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| $\hat{E}_s/I_{ot}$ | | 1~6 | dB | TBD | TBD |
| SSB RSRP Note3 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2,4,5 | dBm/SSB SCS | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3,6 | | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| Io Note3 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2,4,5 | dBm/9.36 MHz | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3,6 | dBm/38.16 MHz | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |

| | | | | |
|---|---|---|---|---|
| $\hat{E}_s/N_{oc}$ | 1~6 | dB | TBD | TBD |
| Propagation condition | 1~6 | | AWGN | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | |

### A.4.7.4.1.3 Test Requirements

The L1-RSRP measurement accuracy for SSB#0 and SSB#1 of Cell 2 shall fulfil the requirements in sections 10.1.19.1.

Editor's Note: which reports are used to verify the accuracy is FFS A.4.7.4.2 CSI-RS based L1-RSRP measurement

### A.4.7.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 9.5.3 and section 10.1.19.2 for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in Table A.4.7.4.2.1-1.

**Table A.4.7.4.2.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 15 kHz CSI-RS SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | LTE FDD, NR 15 kHz CSI-RS SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 30kHz CSI-RS SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 15 kHz CSI-RS SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | LTE TDD, NR 15 kHz CSI-RS SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | LTE TDD, NR 30kHz CSI-RS SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

### A.4.7.4.2.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.7.4.2.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in Table A.4.7.4.2.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform L1-RSRP measurement based on the CSI-RS resources 0 and 1. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB. Repetition is configured as TBD for the CSI-RS resource set.

**Table A.4.7.4.2.2-1: FR1 CSI-RS based L1-RSRP test parameters**

| Parameter | | Config | Unit | Test 1 | Test 2 |
|---|---|---|---|---|---|
| SSB GSCN | | 1~6 | | freq1 | freq1 |
| Duplex mode | | 1,4 | | FDD | FDD |
| | | 2,5 | | TDD | TDD |
| | | 3,6 | | TDD | TDD |
| TDD Configuration | | 1,4 | | N/A | N/A |
| | | 2,5 | | TDDConf.1.1 | TDDConf.1.1 |
| | | 3,6 | | TDDConf.2.1 | TDDConf.2.1 |
| $BW_{channel}$ | | 1,4 | MHz | 10: $N_{RB,c}$ = 52 | 10: $N_{RB,c}$ = 52 |
| | | 2,5 | | 10: $N_{RB,c}$ = 52 | 10: $N_{RB,c}$ = 52 |
| | | 3,6 | | 40: $N_{RB,c}$ = 106 | 40: $N_{RB,c}$ = 106 |
| PDSCH Reference measurement channel | | 1,4 | | SR.1.1 FDD | SR.1.1 FDD |
| | | 2,5 | | SR.1.1 TDD | SR.1.1 TDD |
| | | 3,6 | | SR.2.1 TDD | SR.2.1 TDD |
| RMSI CORESET Reference Channel | | 1,4 | | CR.1.1 FDD | CR.1.1 FDD |
| | | 2,5 | | CR.1.1 TDD | CR.1.1 TDD |
| | | 3,6 | | CR.2.1 TDD | CR.2.1 TDD |
| Dedicated CORESET Reference Channel | | 1,4 | | CCR.1.1 FDD | CCR.1.1 FDD |
| | | 2,5 | | CCR.1.1 TDD | CCR.1.1 TDD |
| | | 3,6 | | CCR.2.1 TDD | CCR.2.1 TDD |
| SSB configuration | | 1,4 | | SSB.1 FR1 | SSB.1 FR1 |
| | | 2,5 | | SSB.1 FR1 | SSB.1 FR1 |
| | | 3,6 | | SSB.2 FR1 | SSB.2 FR1 |
| OCNG Patterns | | 1~6 | | OP.1 | OP.1 |
| DL BWP | | 1~6 | | DLBWP.1.1 | DLBWP.1.1 |
| UL BWP | | 1~6 | | ULBWP.1.1 | ULBWP.1.1 |
| SMTC configuration | | 1~6 | | SMTC.1 | SMTC.1 |
| CSI-RS 0 | | 1,4 | | CSI-RS 1.2 FDD | CSI-RS 1.2 FDD |
| | | 2,5 | | CSI-RS 1.2 TDD | CSI-RS 1.2 TDD |
| | | 3,6 | | CSI-RS 2.2 TDD | CSI-RS 2.2 FDD |
| CSI-RS 1 | | 1,4 | | CSI-RS 1.3 FDD | CSI-RS 1.3 FDD |
| | | 2,5 | | CSI-RS 1.3 TDD | CSI-RS 1.3 TDD |
| | | 3,6 | | CSI-RS 2.3 TDD | CSI-RS 2.3 FDD |
| Number of reported RS | | 1~6 | | 2 | 2 |
| EPRE ratio of PSS to SSS | | 1~6 | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | | | | |
| EPRE ratio of OCNG DMRS to SSS Note 1 | | | | | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 | | | | | |
| $N_{oc}$ Note2 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1~6 | dBm/15kHz | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| $N_{oc}$ Note2 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2,4,5 | dBm/CSI-RS SCS | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |

| | | | | | |
|---|---|---|---|---|---|
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3,6 | | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| $\hat{E}_s/I_{ot}$ | | 1~6 | dB | TBD | TBD |
| CSI-RS RSRP Note3 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2,4,5 | dBm/CSI-RS SCS | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3,6 | | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| Io Note3 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2,4,5 | dBm/9.36 MHz | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3,6 | dBm/38.16 MHz | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |

| | | | | |
|---|---|---|---|---|
| $\hat{E}_s/N_{oc}$ | 1~6 | dB | TBD | TBD |
| Propagation condition | 1~6 | | AWGN | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | |

#### A.4.7.4.2.3 Test Requirements

The L1-RSRP measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 2 shall fulfil the requirements in sections 10.1.19.2.

Editor's Note: which reports are used to verify the accuracy is FFS

# A.4.8 PSCell addition and release delay

## A.4.8.1 Addition and Release Delay of known NR PSCell

### A.4.8.1.1 Test purpose and environment

The purpose of this test is to verify that the NR PSCell addition and release delays under EN-DC are within the requirements stated in section 7.31.2 [15] for the case when the PSCell is known by the UE at the time of addition.

Supported test configurations are shown in A.4.8.1.1-1. The test parameters for the E-UTRA cell are given in Table A.3.7.2.1-1. The E-UTRA cell once set up is not changed across time.

The test parameters for NR cell are given in Tables A.4.8.1.1-2 and cell-specific parameters in A.4.8.1.1-3 below. The test consists of five successive time periods with duration of T1, T2, T3, T4 and T5 respectively. There are two carriers each with one cell. Before the test starts the UE is connected to Cell 1 (E-UTRA PCell) on radio channel 1 (PCC) but is not aware of Cell 2 (NR PSCell) on radio channel 2. The UE is only monitoring the PCC. During T1 only Cell1 is known to the UE.

Before the start of T2, the UE in the measurement control information that event-triggered reporting with Event A4 is configured for neighbour cell (Cell2). Before the start of T2 the UE is configured with the measurement gaps (gap pattern Id # 0). The Cell2 becomes known to the UE during T2. Therefore, during T2 the UE shall report Event A4. After receiving the Event A4, the test system shall send a RRC message to the UE to release the measurement gaps.

The test system shall send a RRC message to the UE to add PSCell (Cell 2) on radio channel 2. The RRC message (to add PSCell) also includes a request for the UE to start periodic CSI reporting for the PSCell after the PSCell has been successfully added. The RRC message to add PSCell shall be sent to the UE during period T2, after the measurement gaps are released by the test system. The point in time at which the RRC message to add PSCell (Cell2) is received at the UE antenna connector defines the start of period T3.

The test system shall observe the periodic reporting of CSI for PSCell during T4. The point in time at which the UE has sent PRACH to the PSCell (Cell 2) defines the start of period T4.

The test system shall send a RRC message to the UE to release PSCell (Cell 2) on radio channel 2. The RRC message to release PSCell (Cell2) shall be sent to the UE during period T4, after the UE has sent at least one CQI report with non-zero CQI index for PSCell (Cell 2). The point in time at which the RRC message to release PSCell (Cell2) is received at the UE antenna connector defines the start of period T5.

**Table A.4.8.1.1-1: Supported test configurations for FR1 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR SCS 15 kHz, BW 10 MHz, FDD |
| 2 | LTE FDD, NR SCS 15 kHz, BW 10 MHz, TDD |
| 3 | LTE FDD, NR SCS 30 kHz, BW 40 MHz, TDD |
| 4 | LTE FDD, NR SCS 15 kHz, BW 10 MHz, FDD |
| 5 | LTE FDD, NR SCS 15 kHz, BW 10 MHz, TDD |
| 6 | LTE FDD, NR SCS 30 kHz, BW 40 MHz, TDD |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

Table A.4.8.1.1-2: General Test Parameters for PSCell Addition and Release

| Parameter | | Unit | Value | Comment |
|---|---|---|---|---|
| RF Channel Number | | | 1, 2 | Two radio channels are used for this test. One for E-UTRA cell and second for NR Cell |
| Initial Condition | Active PCell | | Cell1 | PCell on RF channel number 1. |
| | Neighbour cell | | Cell2 | Neighbour cell on RF channel number 2. |
| Final Condition | Active PCell | | Cell1 | PCell on RF channel number 1. |
| | Neighbour Cell | | Cell2 | PSCell on RF channel number 2. |
| A4 | Hysteresis | dB | 0 | Hysteresis for evaluation of event A4. |
| | Threshold RSRP | dBm | -93 | Actual RSRP threshold for event A4. Needs to take absolute accuracy tolerance in section 9.1.11.1 into account plus margin. |
| | Time to Trigger | S | 0 | |
| DRX | | | OFF | Continuous monitoring of primary cell |
| Measurement gap pattern Id | | | 0 | Gaps are configured before T2 and released before T3. |
| PRACH configuration on cell2 | | | FR1 PRACH configuration 2 | Captured in [A.3.8.2.1] |
| CQI/PMI periodicity and offset configuration index on cell2 | | | TBD | CQI reporting for PSCell every uplink subframe |
| Cell-individual offset for cells on RF channel number 1 | | dB | 0 | Individual offset for cells on primary component carrier. |
| Cell-individual offset for cells on RF channel number 2 | | dB | 0 | Individual offset for cells on carrier frequency of cell2. |
| T1 | | S | 5 | During this time the PCell shall be known and cell2 shall be unknown. |
| T2 | | S | ≤ 5 | During this time the UE shall identify neighbour cell (cell2) and report event A4. |
| T3 | | S | 1 | During this time the UE adds the PSCell. |
| T4 | | S | 1 | During this time the UE sends CSI reports for PSCell. |
| T5 | | S | 1 | During this time the UE releases the PSCell. |

**Table A.4.8.1.1-3: Cell Specific Parameters for PSCell Addition and Release**

| Parameter | | Unit | Config | Test T1 | T2 | T3 | T4 | T5 |
|---|---|---|---|---|---|---|---|---|
| E-UTRA RF Channel Number | | | 1,2,3,4,5,6 | 1 | | | | |
| NR RF Channel Number | | | 1,2,3,4,5,6 | 2 | | | | |
| TDD configuration | | | 1,4 | Not Applicable | | | | |
| | | | 2,5 | TDDConf.1.1 | | | | |
| | | | 3,6 | TDDConf.1.2 | | | | |
| $BW_{channel}$ | | MHz | 1,4 | 10: $N_{RB,c}$ = 52 | | | | |
| | | | 2,5 | 10: $N_{RB,c}$ = 52 | | | | |
| | | | 3,6 | 40: $N_{RB,c}$ = 106 | | | | |
| BWP | DL BWP | | 1,2,3,4,5,6 | DLBWP.1.1 | | | | |
| | UL BWP | | 1,2,3,4,5,6 | ULBWP.1.1 | | | | |
| PDSCH Reference measurement channel | | | 1,4 | SR.1.1 FDD | | | | |
| | | | 2,5 | SR.1.1 TDD | | | | |
| | | | 3,6 | SR.2.1 TDD | | | | |
| RMSI CORESET Reference Channel | | | 1,4 | CR.1.1 FDD | | | | |
| | | | 2,5 | CR.1.1 TDD | | | | |
| | | | 3,6 | CR.2.1 TDD | | | | |
| Dedicated CORESET Reference Channel | | | 1,4 | CCR.1.1 FDD | | | | |
| | | | 2,5 | CCR.1.1 TDD | | | | |
| | | | 3,6 | CCR.2.1 TDD | | | | |
| OCNG Patterns | | | 1,2,3,4,5,6 | OP.1 | | | | |
| SSB configuration | | | 1,2,4,5 | SSB.1 FR1 | | | | |
| | | | 3,6 | SSB.2 FR1 | | | | |
| SMTC configuration | | | 1,2,4,5 | SMTC.1 | | | | |
| | | | 3,6 | SMTC.1 | | | | |
| EPRE ratio of PSS to SSS | | dB | 1,2,3,4,5,6 | 0 | | | | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | | |
| $N_{oc}$ Note2 | | dBm/15 kHz | 1,2,3,4,5,6 | N/A | -85 | | | |
| $N_{oc}$ Note2 | | dBm/SCS | 1,2,4,5 | N/A | -85 | | | |
| | | | 3,6 | N/A | -82 | | | |
| $\hat{E}_s/I_{ot}$ | | | 1,2,3,4,5,6 | -infinity | 0 | | | |

| | | | | |
|---|---|---|---|---|
| $\hat{E}_s/N_{oc}$ | | 1,2,3,4,5,6 | -infinity | 0 |
| SS-RSRP Note3 | dBm/SCS | 1,2,4,5 | -infinity | -85 |
| | | 3,6 | -infinity | -82 |
| Io Note3 | dBm/9.36MHz | 1,2,4,5 | N/A | -57 |
| | dBm/38.1MHz | 3,6 | N/A | -51 |
| Propagation condition | | 1,2,3,4,5,6 | AWGN | |

#### A.4.8.1.2 Test Requirements

The UE shall transmit the PRACH to PSCell at latest 232 ms Note1 into T3.

The UE shall send at least one CSI report for PSCell with non-zero CQI index during T4.

The UE shall periodically send CSI reports for PSCell after the UE has sent first CQI report with non-zero CQI index during T4

The UE shall stop sending CSI reports for PSCell in at latest [20]ms into T5.

All the above test requirements shall be fulfilled in order for the observed PSCell addition delay and PSCell release delay to be counted as correct. The rate of correct observed PSCell addition delay and PSCell release delay during repeated tests shall be at least 90%.

Note1: The PSCell addition delay can be expressed as follows as specified in Clause 7.31.2 [15]:

$$T_{config\_PSCell} = T_{RRC\_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{PSCell\_DU} + 2ms$$ Where:

$T_{RRC\_delay}$ = 20ms

$T_{processing}$ = 20ms

$T_{search}$ = 0

$T_{\Delta}$ = 20ms

$T_{PSCell\_DU}$ = 16*10+10 = 170ms

# A.5 EN-DC tests with PSCell in FR2

## A.5.1 Void

## A.5.2 Void

## A.5.3 RRC_CONNECTED state mobility

### A.5.3.1 Void

### A.5.3.2 RRC Connection Mobility Control

#### A.5.3.2.1 Void

#### A.5.3.2.2 Random Access

##### A.5.3.2.2.1 Contention based random access test in FR2 for PSCell/SCell in EN-DC

###### A.5.3.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.2 and Clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in section A.3.7.2.1 and Cell 2 configured as PSCell or SCell in FR2. Supported test parameters are shown in Table A.5.3.2.2.1.1-1. UE capble of EN-DC with PSCell or SCell in FR2 needs to be tested by using the parameters in Table A.5.3.2.2.1.1-2 and Table A.5.3.2.2.1.1-3.

**Table A.5.3.2.2.1.1-1: Supported test configurations for non-contention based random access test in FR2 for PSCell/SCell in EN-DC**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR PSCell/SCell 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR PSCell/SCell 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability | |

**Table A.5.3.2.2.1.1-2: General test parameters for contention based random access test in FR2 for PSCell/SCell in EN-DC**

| Parameter | | Unit | Test-1 | Comments |
|---|---|---|---|---|
| SSB Configuration | Config 1,2 | | SSB pattern 1 in FR2 | As defined in A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below |
| Number of SSBs per SS-burst | | | 2 | Different from the definition in A.3.10 |
| SS/PBCH block index | | | 0,1 | Different from the definition in A.3.10 |
| Duplex Mode for Cell 2 | Config 1,2 | | TDD | |
| TDD Configuration | Config 1,2 | | TDDConf.3.1 | |
| OCNG Pattern Note 1 | | | OCNG pattern 1 | As defined in A.3.2.1. |
| PDSCH parameters Note 2 | Config 1,2 | | SR3.1 TDD | As defined in A.3.1.1. |
| NR RF Channel Number | | | 1 | |
| EPRE ratio of PSS to SSS | | dB | 0 | |
| EPRE ratio of PBCH_DMRS to SSS | | dB | | |
| EPRE ratio of PBCH to PBCH_DMRS | | dB | | |
| EPRE ratio of PDCCH_DMRS to SSS | | dB | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | dB | | |
| EPRE ratio of PDSCH_DMRS to SSS | | dB | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | dB | | |
| Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.<br>Note 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required. | | | | |

**Table A.5.3.2.2.1.1-3: OTA-related test parameters for contention based random access test in FR2 for PSCell/SCell in EN-DC**

| Parameter | | | Unit | Test-1 | Comments |
|---|---|---|---|---|---|
| AoA setup | | | | TBD | As defined in A.x. |
| SSB with index 0 | $\hat{E}_s/I_{ot}$ | | dB | 3 | SSB with index 0 is signalled to be above configured *rsrp-ThresholdSSB* |
| | $N_{oc}$ | Config 1,2 | dBm/15kHz | TBD | |
| | $\hat{E}_s/N_{oc}$ | | dB | 3 | |
| | SS-RSRP Note 2 | | dBm/ SCS | TBD | |
| SSB with index 1 | $\hat{E}_s/I_{ot}$ | | dB | -17 | SSB with index 1 is signalled to be below configured *rsrp-ThresholdSSB* |
| | $N_{oc}$ | Config 1,2 | dBm/15kHz | TBD | |
| | $\hat{E}_s/N_{oc}$ | | dB | -17 | |
| | SS-RSRP Note 2 | | dBm/ SCS | TBD | |
| Io Note 1 | | Config 1,2 | dBm | TBD | For symbols without SSB index 1 |
| ss-PBCH-BlockPower | | | dBm/ SCS | TBD | As defined in clause 6.3.2 in TS 38.331 [2]. |
| Configured UE transmitted power ($P_{\mathrm{CMAX,\ f,c}}$) | | | dBm | TBD | As defined in clause 6.2.4 in TS 38.101-2. |
| PRACH Configuration | | | | FR2 PRACH configuration 1 | As defined in A.3.8.3. |
| Propagation Condition | | | - | AWGN | |
| Note 1: Io level has been derived from other parameters for information purpose. It is not a settable parameter.<br>Note 2: RSRP level has been derived from other parameters for information purposes. It is not a settable parameter. | | | | | |

### A.5.3.2.2.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

#### A.5.3.2.2.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in Subclause 6.2.2.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be [TBD] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

#### A.5.3.2.2.1.2.2 Random Access Response Reception

To test the UE behavior specified in Subclause 6.2.2.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be [TBD] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.5.3.2.2.1.2.3 No Random Access Response Reception

To test the UE behavior specified in subclause 6.2.2.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2.. The power of the first preamble shall be [TBD] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.5.3.2.2.1.2.4 Receiving a NACK on msg3

To test the UE behavior specified in subclause 6.2.2.2.1.4 the System Simulator shall NACK *all* UE msg3 following a successful Random Access Response.

The UE shall re-transmit the msg3 upon the reception of a NACK on msg3 until the maximum number of HARQ re-transmissions is reached.

###### A.5.3.2.2.1.2.5 Reception of an Incorrect Message over Temporary C-RNTI

To test the UE behavior specified in Subclause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element *not* matching the CCCH SDU transmitted in msg3 uplink message.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

###### A.5.3.2.2.1.2.6 Reception of a Correct Message over Temporary C-RNTI

To test the UE behavior specified in Subclause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element matching the CCCH SDU transmitted in the msg3 uplink message.

The UE shall send ACK if the Contention Resolution is successful.

###### A.5.3.2.2.1.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in Subclause 6.2.2.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

##### A.5.3.2.2.2 Non-contention based random access test in FR2 for PSCell/SCell in EN-DC

###### A.5.3.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.2 and Clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in section A.3.7.2.1 and Cell 2 configured as PSCell or SCell in FR2. Supported test parameters are shown in Table A.5.3.2.2.2.1-1. UE capble of EN-DC with PSCell in FR1 needs to be tested by using the parameters in Table A.5.3.2.2.2.1-2 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2).

**Table A.5.3.2.2.2.1-1: Supported test configurations for non-contention based random access test in FR2 for PSCell/SCell in EN-DC**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR PSCell/SCell 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR PSCell/SCell 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability | |

**Table A.5.3.2.2.2.1-2: General test parameters for non-contention based random access test in FR2 for PSCell/SCell in EN-DC**

| Parameter | | Unit | Test-1 | Test-2 | Comments |
|---|---|---|---|---|---|
| SSB Configuration | Config 1,2 | | SSB pattern 1 in FR2 | SSB pattern 1 in FR2 | As defined in A.3.10, except of Number of SS per SS-burst and SS/PBCH block index below |
| Number of SSBs per SS-burst | | | 2 | 2 | Different from the defini in A.3.10 |
| SS/PBCH block index | | | 0,1 | 0,1 | Different from the defini in A.3.10 |
| CSI-RS Configuration | Config 1,2 | | N/A | CSI-RS.3.1 TDD | As defined in A.3.1.4 |
| Duplex Mode for Cell 2 | Config 1,2 | | TDD | TDD | |
| TDD Configuration | Config 1,2 | | TDDConf.3.1 | TDDConf.3.1 | |
| OCNG Pattern Note 1 | | | OCNG pattern 1 | OCNG pattern 1 | As defined in A.3.2.1 |
| PDSCH parameters Note 2 | Config 1,2 | | SR3.1 TDD | SR3.1 TDD | As defined in A.3.1.1 |
| NR RF Channel Number | | | 1 | 1 | |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 | |
| EPRE ratio of PBCH_DMRS to SSS | | dB | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | dB | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | dB | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | dB | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | dB | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | dB | | | |
| Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achiev for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel. | | | | | |
| Note 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required. | | | | | |

**Table A.5.3.2.2.2.1-3: OTA-related test parameters for non-contention based random access test in FR2 for PSCell/SCell in EN-DC**

| Parameter | | | Unit | Test-1 | Test-2 | Comments |
|---|---|---|---|---|---|---|
| AoA setup | | | | TBD | TBD | As defined in A.x. |
| SSB with index 0 | $\hat{E}_s/I_{ot}$ | | dB | 3 | 3 | SSB with index 0 is signalled to be above configured *rsrp-ThresholdSSB* |
| | $N_{oc}$ | Config 1,2 | dBm/15kHz | TBD | TBD | |
| | $\hat{E}_s/N_{oc}$ | | dB | 3 | 3 | |
| | SS-RSRP Note 2 | | dBm/ SCS | TBD | TBD | |
| SSB with index 1 | $\hat{E}_s/I_{ot}$ | | dB | -17 | -17 | SSB with index 1 is signalled to be below configured *rsrp-ThresholdSSB* |
| | $N_{oc}$ | Config 1,2 | dBm/15kHz | TBD | TBD | |
| | $\hat{E}_s/N_{oc}$ | | dB | -17 | -17 | |
| | SS-RSRP Note 2 | | dBm/ SCS | TBD | TBD | |
| Io Note 1 | | Config 1,2 | dBm | TBD | TBD | For symbols without SS index 1 |
| ss-PBCH-BlockPower | | | dBm/ SCS | TBD | TBD | As defined in clause 6.3 in TS 38.331 [2]. |
| Configured UE transmitted power ( $P_{\text{CMAX, f,c}}$ ) | | | dBm | TBD | TBD | As defined in clause 6.2 in TS 38.101-2. |
| PRACH Configuration | | | | FR2 PRACH configuration 2 | FR2 PRACH configuration 3 | As defined in A.3.8.3 |
| Propagation Condition | | | - | AWGN | AWGN | |
| Note 1: Io level has been derived from other parameters for information purpose. It is not a settable parameter.<br>Note 2: RSRP level has been derived from other parameters for information purposes. It is not a settable parameter. | | | | | | |

### A.5.3.2.2.2.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

#### A.5.3.2.2.2.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in Subclause 6.2.2.2.2.1 for SSB-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be [TBD] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

#### A.5.3.2.2.2.2.2 CSI-RS-based Random Access Preamble Transmission

In Test-2, to test the UE behavior specified in Subclause 6.2.2.2.2.1 for CSI-RS-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the CSI-RS configured.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-OccasionList*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be [TBD] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.5.3.2.2.2.2.3 Random Access Response Reception

To test the UE behavior specified in Subclause 6.2.2.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be [TBD] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.5.3.2.2.2.2.4 No Random Access Response Reception

To test the UE behavior specified in subclause 6.2.2.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be [TBD] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

#### A.5.3.2.3 Void

## A.5.4 Timing

### A.5.4.1 UE transmit timing

#### A.5.4.1.1 NR UE Transmit Timing Test for FR2

##### A.5.4.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in Table 5.4.1.1.1-1.

**Table A.5.4.1.1.1-1: Supported test configurations for FR2 PSCell**

| Configuration | Description |
|---|---|
| 1 | TDD, SSB SCS 240 KHz, data SCS 120kHz, BW 100MHz |

For this test a single NR cell is used. Table A.5.4.1.1.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in Table A.5.4.1.1.1-3.

**Table A.5.4.1.1.1-2: Cell Specific Test Parameters for UL Transmit Timing test**

| Parameter | Unit | Config | Test1 | Test2 | Band Group |
|---|---|---|---|---|---|
| SSB ARFCN | | 1 | Freq1 | Freq1 | |
| Duplex Mode | | 1 | TDD | | |
| TDD configuration | | 1 | TDDConf.1.2 | | |
| $BW_{channel}$ | MHz | 1 | 100: NRB,c = 66 | | |
| BWP BW | MHz | 1 | 100: NRB,c = 66 | | |
| DRx Cycle | ms | 1 | N/A | 320 Note5 | |
| PDSCH Reference measurement channel | | 1 | SR.3.1 TDD | | |
| CORESET Reference Channel | | 1 | CR.3.1 TDD | | |
| OCNG Patterns | | 1 | OCNG pattern 1 | | |
| SMTC configuration | | 1 | FR2 pattern 2 | | |
| PDSCH/PDCCH subcarrier spacing | kHz | 1 | 120 | | |
| EPRE ratio of PSS to SSS | dB | 1 | 0 | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | |
| $N_{oc}$ Note2 | dBm/15 kHz | 1 | TBD | TBD | |
| $N_{oc}$ Note2 | dBm/SCS | 1 | TBD | TBD | |
| $\hat{E}_s/I_{ot}$ | | 1 | 3 | 3 | |
| $\hat{E}_s/N_{oc}$ | | 1 | 3 | 3 | |
| SS-RSRP Note3 | dBm/SCS | 1 | TBD | TBD | |
| Io Note3 | dBm/95MHz | 1 | TBD | TBD | |
| Propagation condition | | 1 | AWGN | | |
| SRS Config | | 1 | Config1 Note6 | Config2 Note6 | |

| | |
|---|---|
| Note 1: | OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. |
| Note 2: | Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. |
| Note 3: | SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |
| Note 4: | SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. |
| Note 5: | DRx related parameters are given in Table A.5.4.1.1.1-4 |
| Note 6: | SRS configs are given in Table A.5.4.1.1.1-3 |

**Table A.5.4.1.1.1-3: SRS Configuration for Timing Accuracy Test**

| | Field | Config1 | Config 2 | Comments |
|---|---|---|---|---|
| SRS-ResourceSet | srs-ResourceSetId | 0 | 0 | |
| | srs-ResourceIdList | 0 | 0 | |
| | resourceType | Periodic | Periodic | |
| | Usage | Codebook | Codebook | |
| | SRS-ResourceSetId | 0 | 0 | |
| SRS-Resource | nrofSRS-Ports | Port1 | Port1 | |
| | transmissionComb | n2 | n2 | |
| | combOffset-n2 | 0 | 0 | |
| | cyclicShift-n2 | 0 | 0 | |
| | resourceMapping startPosition | 0 | 0 | |
| | resourceMapping nrofSymbols | n1 | n1 | |
| | resourceMapping repetitionFactor | n1 | n1 | |
| | freqDomainPosition | 0 | 0 | |
| | freqDomainShift | 0 | 0 | |
| | freqHopping c-SRS | sl1 | sl1 | |
| | freqHopping b-SRS | 0 | 0 | |
| | freqHopping b-hop | 0 | 0 | |
| | groupOrSequenceHopping | Neither | Neither | |
| | resourceType | Periodic | Periodic | |
| | periodicityAndOffset-p | sl1 | sl640 | Offset to align with DRx periodicity |
| | sequenceId | 0 | 0 | Any 10 bit number |

**Table A.5.4.1.1.1-4: DRX-Configuration for UL Timing Tests.**

| Field | Test 2 |
|---|---|
| | Value |
| drx-onDurationTimer | TBD |
| drx-InactivityTimer | TBD |
| drx-RetransmissionTimerDL | TBD |
| drx-RetransmissionTimerUL | TBD |
| longDRX-CycleStartOffset | TBD |
| shortDRX | TBD |

### A.5.4.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Set up E-UTRA PCell according to parameters given in Table A.3.7.2.1-1 and setup NR PSCell according to parameters given in Table A.5.4.1.1.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within ($N_{TA}$ + $N_{TA\_offset}$) ± $T_e$ of the first detected path of DL SSB.

   a. The $N_{TA}$ offset value (in $T_c$ units) is 25600 for FR1 and 13792 for FR2

   b. The $T_e$ values depend on the DL and UL SCS for which the test is being run and are given in Table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in Table A.5.4.1.1.2-1

**Table A.5.4.1.1.2-1 Adjustment Value for DL Timing**

| SCS of SSB signals (KHz) | Adjustment Value | |
|---|---|---|
| | Test1 | Test2 |
| 15 | +64*64$T_c$ | +32*64$T_c$ |
| 30 | +32*64$T_c$ | +16*64$T_c$ |
| 120 | +16*64$T_c$ | +8*64$T_c$ |
| 240 | +8*64$T_c$ | +4*64$T_c$ |

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in Section 7.1.2 Table 7.1.2-3. This will only be done for Test1.

5) The test system shall verify that the UE transmit timing offset stays within ($N_{TA}$ + $N_{TA\_offset}$) ± $T_e$ of the first detected path of DL SSB. For Test 2 and Test 4 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment

# A.5.4.2 UE timer accuracy

# A.5.4.3 Timing advance

## A.5.4.3.1 EN-DC FR2 timing advance adjustment accuracy

### A.5.4.3.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

### A.5.4.3.1.2 Test Parameters

Supported test configurations are shown in table A.5.4.3.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.5.4.3.1.2-2, A.5.4.3.1.2-3 and A.5.4.3.1.2-4. The configuration of Cell 1 (LTE PCell) is specified in section A.3.7.2.1.

In all test cases, two cells are used. Cell 1 is the PCell in the primary Timing Advance Group (pTAG) and cell 2 is the PSCell is in the secondary Timing Advance Group (sTAG). Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands for sTAG are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.5.4.3.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured for PSCell in sTAG.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element for sTAG, as specified in Clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to Clause 4.2 in TS 38.213 results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance for sTAG used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements for sTAG, with Timing Advance Command value specified in table A.5.4.3.1.2-2. This value shall result in changes of the timing advance for sTAG used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in Clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in Clause 5.2 in TS 38.321, shall be configured so that it does not expire in the duration of the test.

**Table A.5.4.3.1.2-1: Timing advance supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.5.4.3.1.2-2: General test parameters for timing advance**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF channel number | | Cell 1: 1<br>Cell 2: 2 | 1 for E-UTRAN PCell<br>2 for NR PSCell |
| Timing Advance Command ($T_A$) value during T1 | | 31 | $N_{TA\_new} = N_{TA\_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2 |
| Timing Advance Command ($T_A$) value during T2 | | 39 | $N_{TA\_new} = N_{TA\_old} + 8192*T_c$ (based on equation in TS 38.213 [3] section 4.2) |
| T1 | s | 5 | |
| T2 | s | 5 | |

**Table A.5.4.3.1.2-3: Cell specific test parameters for timing advance**

| Parameter | Unit | Test1 | |
|---|---|---|---|
| | | T1 | T2 |
| Duplex mode | | TDD | |
| TDD configuration | | TDDConf.3.1 | |
| $BW_{channel}$ | MHz | 100: $N_{RB,c}$ = 66 | |
| BWP BW | MHz | 100: $N_{RB,c}$ = 66 | |
| DRx Cycle | ms | Not Applicable | |
| PDSCH Reference measurement channel | | SR.3.1 TDD | |
| CORESET Reference Channel | | CR.3.1 TDD | |
| OCNG Patterns | | OCNG pattern 1 | |
| SMTC configuration | | SMTC.1 FR2 | |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 kHz | |
| PUCCH/PUSCH subcarrier spacing | kHz | 120 kHz | |
| EPRE ratio of PSS to SSS | dB | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | |
| EPRE ratio of PDSCH to PDSCH | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| UE orientation around TBD axis and TBD axis | degrees | TBD | |
| $N_{oc}$ Note2 | dBm/15kHz | -98 | |
| $N_{oc}$ Note2 | dBm/SCS | -89 | |
| $\hat{E}_s/I_{ot}$ | dB | 3 | |
| $\hat{E}_s/N_{oc}$ | dB | 3 | |
| Io Note3 | dBm/ 95.04MHz | -57.96 | |
| Propagation condition | - | AWGN | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | |

**Table A.5.4.3.1.2-4: Sounding Reference Symbol Configuration for timing advance**

| Field | Value | Comment |
|---|---|---|
| c-SRS | 16 | Frequency hopping is disabled |
| b-SRS | 0 | |
| b-hop | 0 | |
| freqDomainPosition | 0 | Frequency domain position of SRS |
| freqDomainShift | 0 | |
| groupOrSequenceHopping | neither | No group or sequence hopping |
| SRS-PeriodicityAndOffset | sl5=0 | Once every 5 slots |
| pathlossReferenceRS | ssb-Index=0 | SSB #0 is used for SRS path loss estimation |
| usage | nonCodebook | Non-codebook based UL transmission |
| startPosition | 0 | resourceMapping setting. SRS on last symbol of slot, and 1symbols for SRS without repetition. |
| nrofSymbols | n1 | |
| repetitionFactor | n1 | |
| combOffset-n2 | 0 | transmissionComb setting |
| cyclicShift-n2 | 0 | |
| nrofSRS-Ports | port1 | Number of antenna ports used for SRS transmission |
| Note: For further information see clause 6.3.2 in TS 38.331 [2]. | | |

#### A.5.4.3.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value for PSCell in sTAG to the transmission timing at the designated activation time i.e. $k$ slots after the reception of the timing advance command, where $k$ = 24.

The Timing Advance adjustment accuracy for PSCell in sTAG shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90%.

## A.5.5 Signaling characteristics

### A.5.5.1 Radio link Monitoring

In the following section, any uplink signal transmitted by the UE is used for detecting the In-/Out-of-Sync state of the UE. In terms of measurement, the uplink signal is verified on the basis of the UE output power:

*Editor note: The metric for the detection of the UE UL transmitted signal by the TE is FFS.*

#### A.5.5.1.1 Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with SSB-based RLM RS in non-DRX mode

##### A.5.5.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

Supported test configurations are shown in table A.5.5.1.1.1-1. The test parameters are given in Tables A.5.5.1.1.1-2, A.5.5.1.1.1-3, and A. 5.5.1.1.1-4 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-2. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.5.5.1.1.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] ms. UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms) in test 2.

*Editor note: whether to revise power level to be gradually changed*

*Editor note: Further to revise the SSB configuration to be 2 SSBs and FFS the corresponding power level of the 2nd SSB*

*Editor note: AoA setting needs to be updated.*

*Editor note: test cases may need to be revised for 2 AoA*

**Table A.5.5.1.1.1-1: Supported test configurations for FR2 PSCell**

| Configuration | Description |
|---|---|
| 1 | FDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | TDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

**Table A.5.5.1.1.1-2: General test parameters for FR2 out-of-sync testing in non-DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 1 | Test 2 |
| Active E-UTRA PCell | | | Cell 1 | Cell 1 |
| E-UTRA RF Channel Number | | | 1 | 1 |
| Active PSCell | | | Cell 2 | Cell 2 |
| RF Channel Number | | | 2 | 2 |
| Duplex mode | | | TDD | TDD |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] |
| | Config 2 | | [TDDConf.3.1] | [TDDConf.3.1] |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| | Config 2 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| SSB Configuration | Config 1 | | [Table A.3.2.2.2.1-1] | [Table A.3.2.2.2.1-1] |
| | Config 2 | | [Table A.3.2.2.2.1-1] | [Table A.3.2.2.2.1-1] |
| SMTC Configuration | Config 1 | | Table A.3.2.3.1-1 | Table A.3.2.3.1-1 |
| | Config 2 | | Table A.3.2.3.1-1 | Table A.3.2.3.1-1 |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz |
| | Config 2 | | 120 KHz | 120 KHz |
| PRACH Configuration | Config 1 | | TBD | TBD |
| | Config 2 | | TBD | TBD |
| SSB index assigned as RLM RS | Config 1 | | TBD | TBD |
| | Config 2 | | TBD | TBD |
| OCNG parameters | | | Table A.3.2.1.1-1 | Table A.3.2.1.1-1 |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *OFF* | *OFF* |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |

| | | | | |
|---|---|---|---|---|
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | TBD | TBD |
| ZP CSI-RS configuration | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1 | slot | [40] | [40] |
| | Config 2 | | [40] | [40] |
| NZP CSI-RS configuration | | | TBD | TBD |
| ZP CSI-RS configuration | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| T1 | | s | TBD | TBD |
| T2 | | s | TBD | TBD |
| T3 | | s | TBD | TBD |
| D1 | | s | TBD | TBD |
| Note 1: All configurations are assigned to the UE prior to the start of time period T1.<br>Note 2: UE-specific PDCCH is not transmitted after T1 starts.Note 3: E-UTRAN is in non-DRX mode under test. | | | | |

**Table A.5.5.1.1.1-3: OTA related cell specific test parameters for FR2 (Cell 2) for out-of-sync radio link monitoring tests in non-DRX mode**

| Parameter | | Unit | Test 1 | | | Test 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| UE orientation around TBD axis and TBD axis | | degrees | TBD | | | TBD | | |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1 | dB | [1] | [-7] | [-15] | [1] | [-7] | [-15] |
| | Config 2 | | [1] | [-7] | [-15] | [1] | [-7] | [-15] |
| $N_{oc}$ | | dBm/15 KHz | TBD | | | TBD | | |
| Propagation condition | | | [TDL-A 30ns 75Hz] | | | [TDL-A 30ns 75Hz] | | |

Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.5.5.1.1.1-1.
Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.5.5.1.1.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |
| Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap). | |

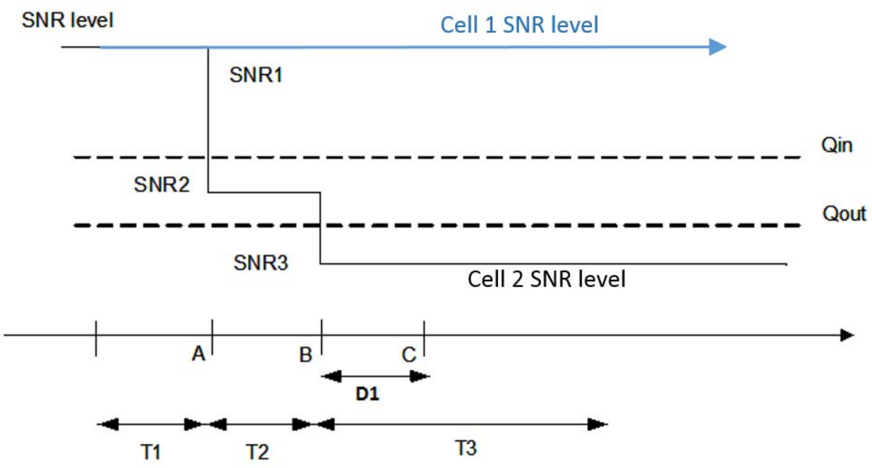


**Figure A.5.5.1.1.1-1: SNR variation for out-of-sync testing**

##### A.5.5.1.1.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

#### A.5.5.1.2 Radio Link Monitoring In-sync Test for FR2 PSCell configured with SSB-based RLM RS in non-DRX mode

##### A.5.5.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

Supported test configurations are shown in table A.5.5.1.2.1-1. The test parameters are given in Tables A.5.5.1.2.1-2, A.5.5.1.2.1-3, and A.5.5.1.2.1-4 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-2. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.1.2.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] ms. UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms) in test 2.

*Editor note: whether to revise power level to be gradually changed*

*Editor note:further to revise the SSB configuration to be 2 SSBs and FFS the corresponding power level of the 2nd SSB*

*Editor note: AoA setting needs to be updated.*

*Editor note: test cases may need to be revised for 2 AoA*

**Table A.5.5.1.2.1-1: Supported test configurations for FR2 PSCell**

| Configuration | Description |
|---|---|
| 1 | FDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | TDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

**Table A.5.5.1.2.1-2: General test parameters for FR2 in-sync testing in non-DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 1 | Test 2 |
| Active E-UTRA PCell | | | Ce1l 1 | Cell 1 |
| E-UTRA RF Channel Number | | | 1 | 1 |
| Active PSCell | | | Cell 2 | Cell 2 |
| RF Channel Number | | | 2 | 2 |
| Duplex mode | | | TDD | TDD |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] |
| | Config 2 | | [TDDConf.3.1] | [TDDConf.3.1] |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| | Config 2 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| SSB Configuration | Config 1 | | [Table A.3.2.2.2.1-1] | [Table A.3.2.2.2.1-1] |
| | Config 2 | | [Table A.3.2.2.2.1-1] | [Table A.3.2.2.2.1-1] |
| SMTC Configuration | Config 1 | | Table A.3.2.3.1-1 | Table A.3.2.3.1-1 |
| | Config 2 | | Table A.3.2.3.1-1 | Table A.3.2.3.1-1 |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz |
| | Config 2 | | 120 KHz | 120 KHz |
| PRACH Configuration | Config 1 | | TBD | TBD |
| | Config 2 | | TBD | TBD |
| SSB index assigned as RLM RS | Config 1 | | TBD | TBD |
| | Config 2 | | TBD | TBD |
| OCNG parameters | | | Table A.3.2.1.1-1 | Table A.3.2.1.1-1 |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| In sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 4 | 4 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 0 | 0 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 0 | 0 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 4 | 4 |

| | | | | |
|---|---|---|---|---|
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *OFF* | *OFF* |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | 2000 | 2000 |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | TBD | TBD |
| ZP CSI-RS configuration | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1 | slot | [40] | [40] |
| | Config 2 | | [40] | [40] |
| NZP CSI-RS configuration | | | TBD | TBD |
| ZP CSI-RS configuration | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| T1 | | s | TBD | TBD |
| T2 | | s | TBD | TBD |
| T3 | | s | TBD | TBD |
| T4 | | s | TBD | TBD |
| T5 | | s | TBD | TBD |
| D1 | | s | TBD | TBD |
| Note 1: All configurations are assigned to the UE prior to the start of time period T1.<br>Note 2: UE-specific PDCCH is not transmitted after T1 starts.<br>Note 3: E-UTRAN is in non-DRX mode under test. | | | | |

**Table A.5.5.1.2.1-3: OTA related cell specific test parameters for FR2 (Cell 2) for in-sync radio link monitoring tests in non-DRX mode**

| Parameter | | Unit | Test 1 | | | | | Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| UE orientation around TBD axis and TBD axis | | degrees | TBD | | | | | TBD | | | | |
| PDCCH_beta | | dB | 4 | | | | | 4 | | | | |
| PDCCH_DMRS_beta | | dB | 4 | | | | | 4 | | | | |
| PBCH_beta | | dB | 0 | | | | | 0 | | | | |
| PSS_beta | | dB | | | | | | | | | | |
| SSS_beta | | dB | | | | | | | | | | |
| PDSCH_beta | | dB | | | | | | | | | | |
| OCNG_beta | | dB | | | | | | | | | | |
| SNR | Config 1 | dB | [1] | [-7] | [-15] | [-4.5] | [1] | [1] | [-7] | [-15] | [-4.5] | [1] |
| | Config 2 | | [1] | [-7] | [-15] | [-4.5] | [1] | [1] | [-7] | [-15] | [-4.5] | [1] |
| $N_{oc}$ | | dBm/15 KHz | TBD | | | | | TBD | | | | |
| Propagation condition | | | [TDL-A 30ns 75Hz] | | | | | [TDL-A 30ns 75Hz] | | | | |

Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.5.5.1.2.1-1.
Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in section [A.3.6].

**Table A.5.5.1.2.1-4: Measurement gap configuration for in-sync tests in non-DRX mode.**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [TBD] |

Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap).

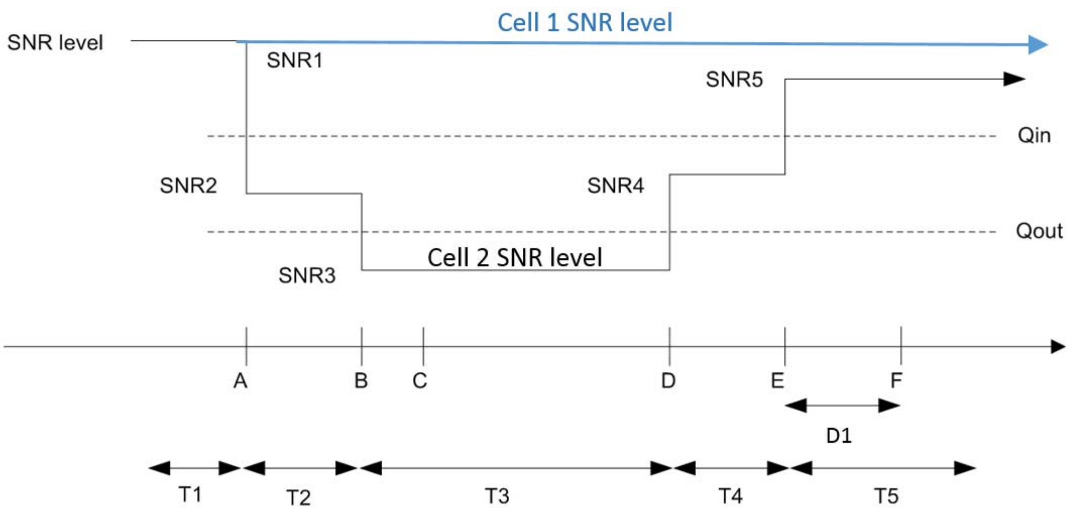


**Figure A.5.5.1.2.1-1: SNR variation for in-sync testing**

#### A.5.5.1.2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

### A.5.5.1.3 Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with SSB-based RLM RS in DRX mode

#### A.5.5.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when DRX is used. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

Supported test configurations are shown in table A.5.5.1.3.1-1. The test parameters are given in Tables A.5.5.1.3.1-2, A.5.5.1.3.1-3, A.5.5.1.3.1-4, and A.5.5.1.3.1-5. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-2. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.5.5.1.3.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

*Editor note: whether to revise power level to be gradually changed*

*Editor note: further to revise the SSB configuration to be 2 SSBs and FFS the corresponding power level of the 2nd SSB*

*Editor note: AoA setting needs to be updated.*

**Table A.5.5.1.3.1-1: Supported test configurations for FR2 PSCell**

| Configuration | Description |
|---|---|
| 1 | FDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | TDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

**Table A.5.5.1.3.1-2: General test parameters for FR2 out-of-sync testing in DRX mode**

| Parameter | | Unit | Value Test 1 |
|---|---|---|---|
| Active E-UTRA PCell | | | Ce1l 1 |
| E-UTRA RF Channel Number | | | 1 |
| Active PSCell | | | Cell 2 |
| RF Channel Number | | | 2 |
| Duplex mode | | | TDD |
| TDD Configuration | Config 1 | | [TDDConf.3.1] |
| | Config 2 | | [TDDConf.3.1] |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] |
| | Config 2 | | [CR. 3.1 TDD] |
| SSB Configuration | Config 1 | | [Table A.3.2.2.2.1-1] |
| | Config 2 | | [Table A.3.2.2.2.1-1] |
| SMTC Configuration | Config 1 | | Table A.3.2.3.1-1 |
| | Config 2 | | Table A.3.2.3.1-1 |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz |
| | Config 2 | | 120 KHz |
| PRACH Configuration | Config 1 | | TBD |
| | Config 2 | | TBD |
| SSB index assigned as RLM RS | Config 1 | | TBD |
| | Config 2 | | TBD |
| OCNG parameters | | | Table A.3.2.1.1-1 |
| CP length | | | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 |
| | Number of Control OFDM symbols | | 2 |
| | Aggregation level | CCE | 8 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 4 |
| | DMRS precoder granularity | | REG bundle size |
| | REG bundle size | | 6 |
| DRX cycle | | | 640 |
| Gap pattern ID | | | [N.A.] |
| Layer 3 filtering | | | *Enabled* |
| T310 timer | | ms | *0* |
| T311 timer | | ms | 1000 |
| N310 | | | 1 |
| N311 | | | 1 |
| NZP CSI-RS configuration | | | TBD |
| ZP CSI-RS configuration | | | TBD |
| CSI-IM configuration | | | TBD |
| Periodic CSI reporting | | | PUCCH |
| CSI reporting periodicity | Config 1 | slot | [40] |
| | Config 2 | | [40] |
| NZP CSI-RS configuration | | | TBD |
| ZP CSI-RS configuration | | | TBD |

| | | |
|---|---|---|
| CSI-IM configuration | | TBD |
| T1 | s | TBD |
| T2 | s | TBD |
| T3 | s | TBD |
| D1 | s | TBD |
| Note 1 All configurations are assigned to the UE prior to the start of time period T1.<br>Note 2: UE-specific PDCCH is not transmitted after T1 starts.<br>Note 3: E-UTRAN is in non-DRX mode under test. | | |

| **Table A.5.5.1.3.1-3: OTA related cell specific test parameters for FR2 (Cell 2) for out-of-sync radio link monitoring tests in DRX modeParameter** | | **Unit** | **Test 1** | | |
|---|---|---|---|---|---|
| | | | **T1** | **T2** | **T3** |
| UE orientation around TBD axis and TBD axis | | degrees | TBD | | |
| PDCCH_beta | | dB | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | |
| PBCH_beta | | dB | 0 | | |
| PSS_beta | | dB | | | |
| SSS_beta | | dB | | | |
| PDSCH_beta | | dB | | | |
| OCNG_beta | | dB | | | |
| SNR | Config 1 | dB | [1] | [-7] | [-15] |
| | Config 2 | | [1] | [-7] | [-15] |
| $N_{oc}$ | | dBm/15 KHz | TBD | | |
| Propagation condition | | | [TDL-A 30ns 75Hz] | | |
| Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.5.5.1.3.1-1.<br>Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6]. | | | | | |

**Table A.5.5.1.3.1-4: DRX-Configuration for out-of-sync tests**

| **Field** | **Test 1** |
|---|---|
| | **Value** |
| drx-onDurationTimer | [ms6] |
| drx-InactivityTimer | [ms1] |
| drx-RetransmissionTimerDL | [sl1] |
| drx-RetransmissionTimerUL | [sl1] |
| longDRX-CycleStartOffset | [ms640] |
| shortDRX | disable |

**Table A.5.5.1.3.1-5: TimeAlignmentTimer -Configuration for out-of-sync testing**

| **Field** | **Test1** |
|---|---|
| | **Value** |
| TimeAlignmentTimer | [Infinity] |
| periodicityAndOffset in SchedulingRequestResourceConfig | [sl40] |

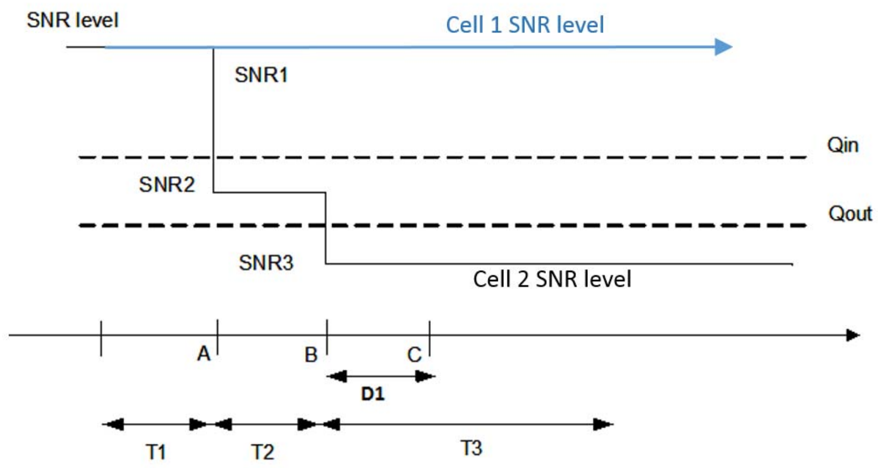


**Figure A.5.5.1.3.1-1: SNR variation for out-of-sync testing**

#### A.5.5.1.3.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

### A.5.5.1.4 Radio Link Monitoring In-sync Test for FR2 PSCell configured with SSB-based RLM RS in DRX mode

#### A.5.5.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when DRX is used. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

Supported test configurations are shown in table A.5.5.1.4.1-1. The test parameters are given in Tables A.5.5.1.4.1-2, A.5.5.1.4.1-3, A.5.5.1.4.1-4 and Table A.5.5.1.4.1-5. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-2. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.1.4.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

*Editor note: whether to revise power level to be gradually changed*

*Editor note: further to revise the SSB configuration to be 2 SSBs and FFS the corresponding power level of the 2nd SSB*

*Editor note: AoA setting needs to be updated.*

**Table A.5.5.1.4.1-1: Supported test configurations for FR2 PSCell**

| Configuration | Description |
|---|---|
| 1 | FDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | TDD LTE PCell, NR 120 KHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

**Table A.5.5.1.4.1-2: General test parameters for FR2 in-sync testing in DRX mode**

| Parameter | | Unit | Value<br>Test 1 |
|---|---|---|---|
| Active E-UTRA PCell | | | Ce1l 1 |
| E-UTRA RF Channel Number | | | 1 |
| Active PSCell | | | Cell 2 |
| RF Channel Number | | | 2 |
| Duplex mode | | | TDD |
| TDD Configuration | Config 1 | | [TDDConf.3.1] |
| | Config 2 | | [TDDConf.3.1] |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] |
| | Config 2 | | [CR. 3.1 TDD] |
| SSB Configuration | Config 1 | | [Table A.3.2.2.2.1-1] |
| | Config 2 | | [Table A.3.2.2.2.1-1] |
| SMTC Configuration | Config 1 | | Table A.3.2.3.1-1 |
| | Config 2 | | Table A.3.2.3.1-1 |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz |
| | Config 2 | | 120 KHz |
| PRACH Configuration | Config 1 | | TBD |
| | Config 2 | | TBD |
| SSB index assigned as RLM RS | Config 1 | | TBD |
| | Config 2 | | TBD |
| OCNG parameters | | | Table A.3.2.1.1-1 |
| CP length | | | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] |
| In sync transmission parameters | DCI format | | 1-0 |
| | Number of Control OFDM symbols | | 2 |
| | Aggregation level | CCE | 4 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 0 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 0 |
| | DMRS precoder granularity | | REG bundle size |
| | REG bundle size | | 6 |
| Out of sync transmission parameters | DCI format | | 1-0 |
| | Number of Control OFDM symbols | | 2 |
| | Aggregation level | CCE | 8 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 4 |
| | DMRS precoder granularity | | REG bundle size |
| | REG bundle size | | 6 |
| DRX cycle | | ms | 40 |
| Gap pattern ID | | | [N.A.] |
| Layer 3 filtering | | | *Enabled* |
| NZP CSI-RS configuration | | | TBD |

| | | | |
|---|---|---|---|
| ZP CSI-RS configuration | | | TBD |
| CSI-IM configuration | | | TBD |
| Periodic CSI reporting | | | PUCCH |
| CSI reporting periodicity | Config 1 | slot | [40] |
| | Config 2 | | [40] |
| NZP CSI-RS configuration | | | TBD |
| ZP CSI-RS configuration | | | TBD |
| CSI-IM configuration | | | TBD |
| T1 | | s | TBD |
| T2 | | s | TBD |
| T3 | | s | TBD |
| T4 | | s | TBD |
| T5 | | s | TBD |
| D1 | | s | TBD |
| Note 1: All configurations are assigned to the UE prior to the start of time period T1.<br>Note 2: UE-specific PDCCH is not transmitted after T1 starts.<br>Note 3: E-UTRAN is in non-DRX mode under test. | | | |

**Table A.5.5.1.4.1-3: OTA related cell specific test parameters for FR2 (Cell 2) for in-sync radio link monitoring test in DRX mode**

| Parameter | | Unit | Test 1 | | | | |
|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T4 | T5 |
| UE orientation around TBD axis and TBD axis | | degrees | TBD | | | | |
| PDCCH_beta | | dB | 4 | | | | |
| PDCCH_DMRS_beta | | dB | 4 | | | | |
| PBCH_beta | | dB | 0 | | | | |
| PSS_beta | | dB | | | | | |
| SSS_beta | | dB | | | | | |
| PDSCH_beta | | dB | | | | | |
| OCNG_beta | | dB | | | | | |
| SNR | Config 1 | dB | [1] | [-7] | [-15] | [-4.5] | [1] |
| | Config 2 | | [1] | [-7] | [-15] | [-4.5] | [1] |
| $N_{oc}$ | | dBm/15 KHz | TBD | | | | |
| Propagation condition | | | [TDL-A 30ns 75Hz] | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.5.5.1.4.1-1.<br>Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in section [A.3.6]. | | | | | | | |

**Table A.5.5.1.4.1-4: DRX-Configuration for in-sync tests**

| Field | Test 1 Value |
|---|---|
| drx-onDurationTimer | [ms6] |
| drx-InactivityTimer | [ms1] |
| drx-RetransmissionTimerDL | [sl1] |
| drx-RetransmissionTimerUL | [sl1] |
| longDRX-CycleStartOffset | [ms40] |
| shortDRX | disable |

**Table A.5.5.1.4.1-5: TimeAlignmentTimer -Configuration for in-sync testing**

| Field | Test 1 Value |
|---|---|
| TimeAlignmentTimer | infinity |
| periodicityAndOffset in SchedulingRequestResourceConfig | [sl40] |

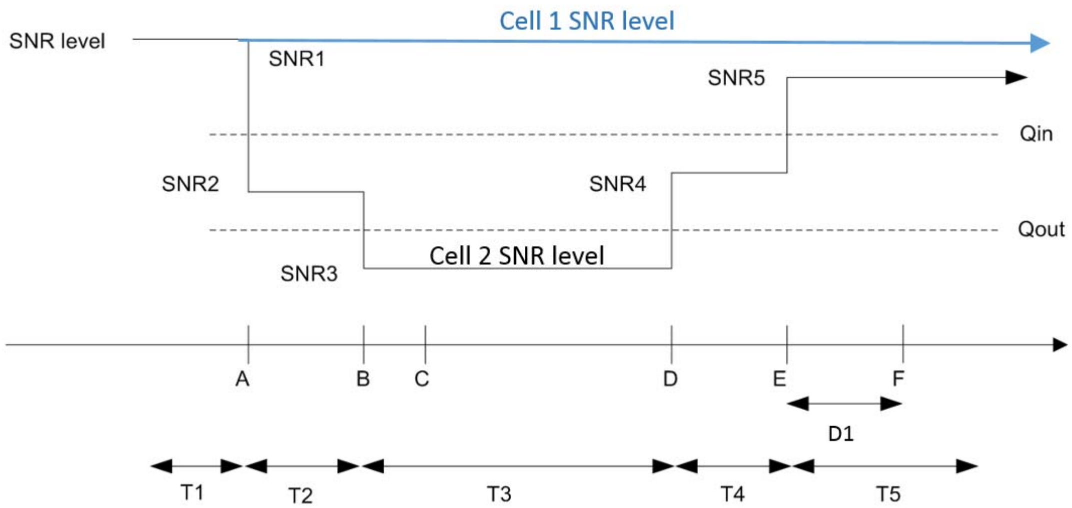


**Figure A.5.5.1.4.1-1: SNR variation for in-sync testing.**

### A.5.5.1.4.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

### A.5.5.1.5 EN-DC Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with CSI-RS-based RLM in non-DRX mode

#### A.5.5.1.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR2 TDD PSCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.5.5.1.5.1-1, A.5.5.1.5.1-2, and A.5.5.1.5.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.5.5.1.5.1-1 shows the variation of the downlink SNR in the E-UTRAN PCell and the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] or [10] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test2.

**Table A.5.5.1.5.1-1: Supported test configurations for FR2 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

**Table A.5.5.1.5.1-2: General test parameters for FR2 PSCell for CSI-RS out-of-sync testing in non-DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 1 | Test 2 |
| Active E-UTRA PCell | | | Cell 1 | Cell 1 |
| E-UTRA RF Channel Number | | | 1 | 1 |
| Active PSCell | | | Cell 2 | Cell 2 |
| RF Channel Number | | | 2 | 2 |
| Duplex Mode | | | TDD | TDD |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] |
| | Config 2 | | [TDDConf.3.1] | [TDDConf.3.1] |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| | Config 2 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 2 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| SMTC Configuration | Config 1 | | TDD | TDD |
| | Config 2 | | TDD | TDD |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz |
| | Config 2 | | 120 KHz | 120 KHz |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *OFF* | *OFF* |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1 | slot | [5] | [5] |
| | Config 2 | | [10] | [10] |
| T1 | | s | 1 | 1 |
| T2 | | s | 0.4 | 0.4 |
| T3 | | s | [0.6] | [0.6] |
| D1 | | s | [0.24] | [0.44] |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts.<br>Note 2: E-UTRAN is in non-DRX mode under test. | | | | |

**Table A.5.5.1.5.1-3: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in non-DRX mode**

| Parameter | | Unit | Test 1 | | | Test 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | TBD | | | TBD | | |
| | Config 2 | | TBD | | | TBD | | |
| Propagation condition | | | [TDL-A 30ns 75Hz] | | | [TDL-A 30ns 75Hz] | | |

Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.1.5.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.5.5.1.5.1-3: Measurement gap configuration for FR2 CSI-RS out-of-sync radio link monitoring in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap)

**Table A.5.5.1.5.1-4: NZP-CSI-RS resource configuration for FR2 CSI-RS out-of-sync radio link monitoring in non-DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation Note 1 | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |

Note 1: TS 38.211 [6] table 7.4.1.5.3-1
Note 2: nrofRBs is derived based on the Configuration in Table A.5.5.1.5.1-1

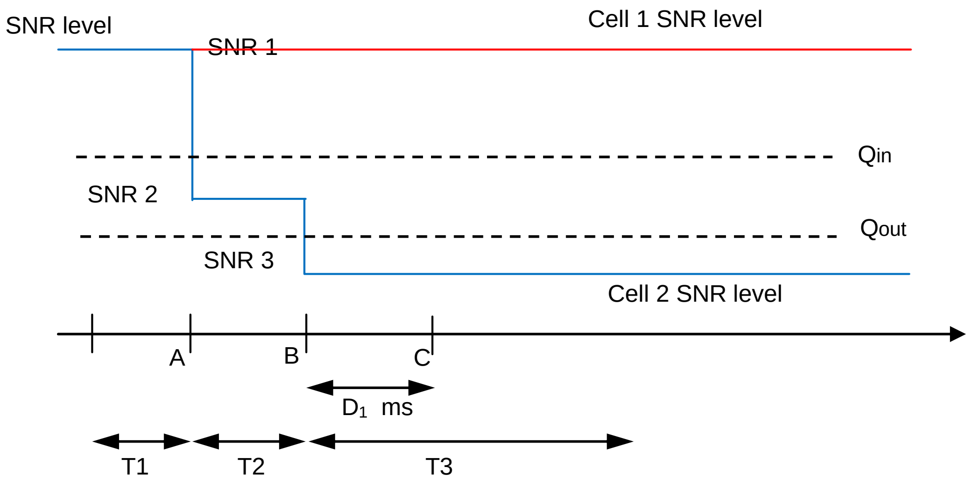


**Figure A.5.5.1.5.1-1: SNR variation for CSI-RS out-of-sync testing**

#### A.5.5.1.5.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1 (E-UTRAN PCell).

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 (PSCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

The UE shall stop transmitting uplink signal in Cell 2 (PSCell) no later than time point C ($D_1$ = [TBD] ms after the start of the time duration T3) on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

### A.5.5.1.6 EN-DC Radio Link Monitoring In-sync Test for FR2 PSCell configured with CSI-RS-based RLM in non-DRX mode

#### A.5.5.1.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR2 TDD PSCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.5.5.1.6.1-1, A.5.5.1.6.1-2, A.5.5.1.6.1-3, A.5.5.1.6.1-4, A.5.5.1.6.1-5, and A.5.5.1.6.1-6 below. There are two cells, cell 1which is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.1.6.1-1 shows the variation of the downlink SNR in the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] or [10] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 4.

**Table A.5.5.1.6.1-1: Supported test configurations for FR2 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

**Table A.5.5.1.6.1-2: General test parameters for FR2 PSCell for CSI-RS in-sync testing in non-DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 3 | Test 4 |
| Active E-UTRA PCell | | | Cell 1 | Cell 1 |
| E-UTRA RF Channel Number | | | 1 | 1 |
| Active PSCell | | | Cell 2 | Cell 2 |
| RF Channel Number | | | 2 | 2 |
| Duplex Mode | | | TDD | TDD |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] |
| | Config 2 | | [TDDConf.3.1] | [TDDConf.3.1] |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| | Config 2 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 2 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| SMTC Configuration | Config 1 | | TDD | TDD |
| | Config 2 | | TDD | TDD |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz |
| | Config 2 | | 120 KHz | 120 KHz |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| In sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 4 | 4 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *OFF* | *OFF* |
| Gap pattern ID | | | [N.A.] | *[*gp0*]* |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |

| | | | | |
|---|---|---|---|---|
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1 | slot | [5] | [5] |
| | Config 2 | | [10] | [10] |
| T1 | | s | 1 | 1 |
| T2 | | s | 0.4 | 0.4 |
| T3 | | s | [0.6] | [0.6] |
| D1 | | s | [0.24] | [0.44] |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts.<br>Note 2: E-UTRAN is in non-DRX mode under test. | | | | |

**Table A.5.5.1.6.1-3: Cell specific test parameters for FR2 for CSI-RS in-sync radio link monitoring in non-DRX mode**

| Parameter | | Unit | Test 3 | | | Test 4 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | TBD | | | TBD | | |
| | Config 2 | | TBD | | | TBD | | |
| Propagation condition | | | [TDL-A 30ns 75Hz] | | | [TDL-A 30ns 75Hz] | | |

Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.1.6.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.5.5.1.6.1-3: Measurement gap configuration for FR2 CSI-RS in-sync radio link monitoring in non-DRX mode**

| Field | Test 4 |
|---|---|
| | Value |
| gapOffset | [0] |
| Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap) | |

**Table A.5.5.1.6.1-4: NZP-CSI-RS resource configuration for FR2 CSI-RS in-sync radio link monitoring in non-DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation Note 1 | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.5.5.1.6.1-1 | | |

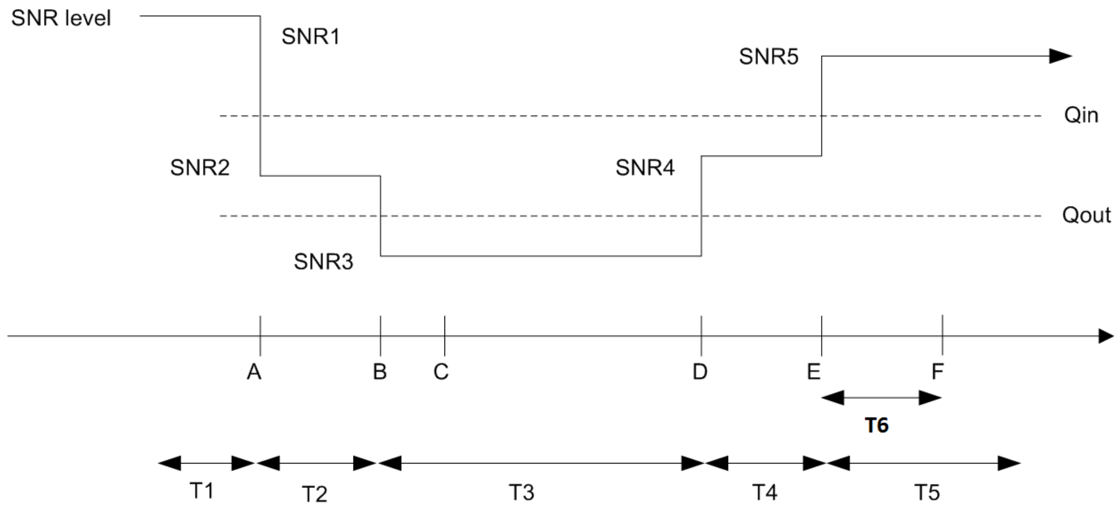


**Figure A.5.5.1.6.1-1: SNR variation for CSI-RS in-sync testing**

### A.5.5.1.6.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

## A.5.5.1.7 EN-DC Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with CSI-RS-based RLM in DRX mode

### A.5.5.1.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR2 TDD PSCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.5.5.1.7.1-1, A.5.5.1.7.1-2, and A.5.5.1.7.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.5.5.1.7.1-1 shows the variation of the downlink SNR in the E-UTRAN PCell and the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] or [10] ms. In the test, DRX configuration is enabled in PSCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 6.

**Table A.5.5.1.7.1-1: Supported test configurations for FR2 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

**Table A.5.5.1.7.1-2: General test parameters for FR2 PSCell for CSI-RS out-of-sync testing in DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 5 | Test 6 |
| Active E-UTRA PCell | | | Cell 1 | Cell 1 |
| E-UTRA RF Channel Number | | | 1 | 1 |
| Active PSCell | | | Cell 2 | Cell 2 |
| RF Channel Number | | | 2 | 2 |
| Duplex Mode | | | TDD | TDD |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] |
| | Config 2 | | [TDDConf.3.1] | [TDDConf.3.1] |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| | Config 2 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 2 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| SMTC Configuration | Config 1 | | TDD | TDD |
| | Config 2 | | TDD | TDD |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz |
| | Config 2 | | 120 KHz | 120 KHz |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *640* | *640* |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1 | slot | [5] | [5] |
| | Config 2 | | [10] | [10] |
| T1 | | s | 1 | 1 |
| T2 | | s | 0.4 | 0.4 |
| T3 | | s | [0.6] | [0.6] |
| D1 | | s | [0.24] | [0.44] |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts.<br>Note 2: E-UTRAN is in non-DRX mode under test. | | | | |

**Table A.5.5.1.7.1-3: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in DRX mode**

| Parameter | | Unit | Test 5 | | | Test 6 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | TBD | | | TBD | | |
| | Config 2 | | TBD | | | TBD | | |
| Propagation condition | | | [TDL-A 30ns 75Hz] | | | [TDL-A 30ns 75Hz] | | |
| Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.<br>Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.<br>Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.<br>Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.<br>Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.1.7.1-1.<br>Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6]. | | | | | | | | |

**Table A.5.5.1.7.1-3: Measurement gap configuration for FR2 CSI-RS out-of-sync radio link monitoring in DRX mode**

| Field | Test 6 |
|---|---|
| | Value |
| gapOffset | [0] |
| Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap) | |

**Table A.5.5.1.7.1-4: NZP-CSI-RS resource configuration for FR2 CSI-RS out-of-sync radio link monitoring in DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation Note 1 | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.5.5.1.7.1-1 | | |

**Table A.5.5.1.7.1-5: DRX-Configuration for FR2 CSI-RS out-of-sync radio link monitoring in DRX mode.**

| Field | Test 5 | Test 6 |
|---|---|---|
| | Value | Value |
| drx-onDurationTimer | [ms6] | [ms6] |
| drx-InactivityTimer | [ms1] | [ms1] |
| drx-RetransmissionTimerDL | [sl1] | [sl1] |
| drx-RetransmissionTimerUL | [sl1] | [sl1] |
| longDRX-CycleStartOffset | [ms640] | [ms40] |
| shortDRX | disable | disable |

**Table A.5.5.1.7.1-6: TimeAlignmentTimer -Configuration for FR2 CSI-RS out-of-sync radio link monitoring in DRX mode.**

| Field | | Test 5 | Test 6 |
|---|---|---|---|
| | | Value | Value |
| TimeAlignmentTimer | | infinity | infinity |
| periodicityAndOffset in SchedulingRequestResourceConfig | Config 1, 2, 4, 5 | [sl5] | [sl5] |
| | Config 3, 6 | [sl10] | [sl10] |

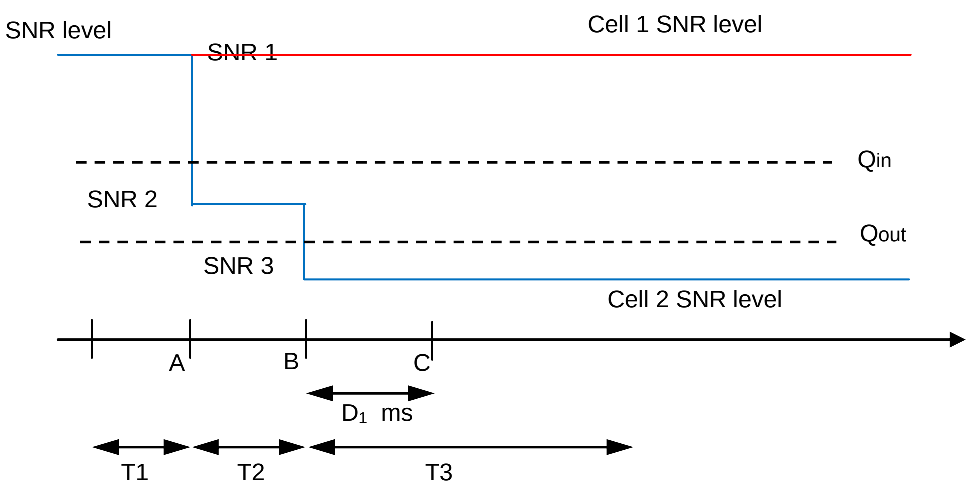


**Figure A.5.5.1.7.1-1: SNR variation for CSI-RS out-of-sync testing**

### A.5.5.1.7.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1 (E-UTRAN PCell).

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 (PSCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

The UE shall stop transmitting uplink signal in Cell 2 (PSCell) no later than time point C ($D_1$ = [TBD] ms after the start of the time duration T3) on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

### A.5.5.1.8 EN-DC Radio Link Monitoring In-sync Test for FR2 PSCell configured with CSI-RS-based RLM in DRX mode

#### A.5.5.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR2 TDD PSCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.5.5.1.8.1-1, A.5.5.1.8.1-2, A.5.5.1.8.1-3 and A.5.5.1.8.1-4 below. There are two cells, cell 1which is the E-UTRAN PCell, and cell 2 is the NR PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.1.8.1-1 shows the variation of the downlink SNR in the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] or [10] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 8.

**Table A.5.5.1.8.1-1: Supported test configurations for FR2 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

**Table A.5.5.1.8.1-2: General test parameters for FR2 PSCell for CSI-RS in-sync testing in non-DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 7 | Test 8 |
| Active E-UTRA PCell | | | Cell 1 | Cell 1 |
| E-UTRA RF Channel Number | | | 1 | 1 |
| Active PSCell | | | Cell 2 | Cell 2 |
| RF Channel Number | | | 2 | 2 |
| Duplex Mode | | | TDD | TDD |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] |
| | Config 2 | | [TDDConf.3.1] | [TDDConf.3.1] |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| | Config 2 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 2 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| SMTC Configuration | Config 1 | | TDD | TDD |
| | Config 2 | | TDD | TDD |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz |
| | Config 2 | | 120 KHz | 120 KHz |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| In sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 4 | 4 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | 640 | 640 |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |

| | | | | |
|---|---|---|---|---|
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1 | slot | [5] | [5] |
| | Config 2 | | [10] | [10] |
| T1 | | s | 1 | 1 |
| T2 | | s | 0.4 | 0.4 |
| T3 | | s | [0.6] | [0.6] |
| D1 | | s | [0.24] | [0.44] |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts.<br>Note 2: E-UTRAN is in non-DRX mode under test. | | | | |

### Table A.5.5.1.8.1-3: Cell specific test parameters for FR2 for CSI-RS in-sync radio link monitoring in non-DRX mode

| Parameter | | Unit | Test 7 | | | Test 8 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | TBD | | | TBD | | |
| | Config 2 | | TBD | | | TBD | | |
| Propagation condition | | | [TDL-A 30ns 75Hz] | | | [TDL-A 30ns 75Hz] | | |
| Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.<br>Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.<br>Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.<br>Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.<br>Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.1.8.1-1.<br>Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6]. | | | | | | | | |

### Table A.5.5.1.8.1-3: Measurement gap configuration for FR2 CSI-RS in-sync radio link monitoring in non-DRX mode

| Field | Test 8 |
|---|---|
| | Value |
| gapOffset | [0] |
| Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap) | |

**Table A.5.5.1.8.1-4: NZP-CSI-RS resource configuration for FR2 CSI-RS in-sync radio link monitoring in non-DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation[Note 1] | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.5.5.1.8.1-1 | | |

**Table A.5.5.1.8.1-5: DRX-Configuration for FR2 CSI-RS in-sync radio link monitoring in DRX mode.**

| Field | Test 5 | Test 6 |
|---|---|---|
| | Value | Value |
| drx-onDurationTimer | [ms6] | [ms6] |
| drx-InactivityTimer | [ms1] | [ms1] |
| drx-RetransmissionTimerDL | [sl1] | [sl1] |
| drx-RetransmissionTimerUL | [sl1] | [sl1] |
| longDRX-CycleStartOffset | [ms640] | [ms40] |
| shortDRX | disable | disable |

**Table A.5.5.1.8.1-6: TimeAlignmentTimer -Configuration for FR2 CSI-RS in-sync radio link monitoring in DRX mode.**

| Field | | Test 5 | Test 6 |
|---|---|---|---|
| | | Value | Value |
| TimeAlignmentTimer | | infinity | infinity |
| periodicityAndOffset in SchedulingRequestResourceConfig | Config 1, 2, 4, 5 | [sl5] | [sl5] |
| | Config 3, 6 | [sl10] | [sl10] |

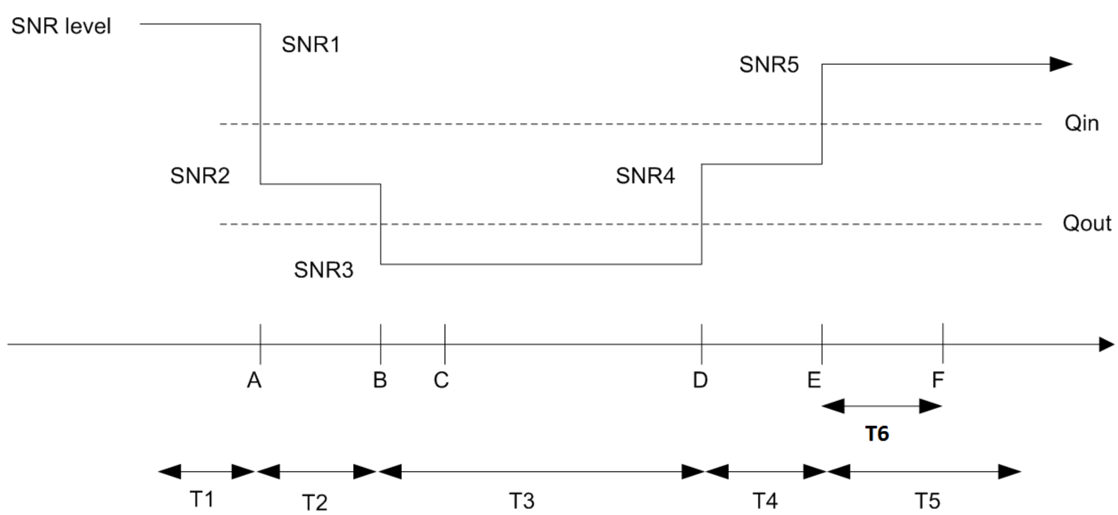


**Figure A.5.5.1.8.1-1: SNR variation for CSI-RS in-sync testing**

#### A.5.5.1.8.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

### A.5.5.2 Interruption

#### A.5.5.2.1 E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

##### A.5.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that when LTE PCell is in DRX and NR PSCell is in non-DRX, NR PSCell interruptions due to transitions from active to non-active and from non-active to active during LTE PCell DRX the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in section 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.1.1-1.

The general test parameters are given in Table A.5.5.2.1.1-2, and NR cell specific test parameters are given in Table A.5.5.2.1.1-3 and A.5.5.2.1.1-4. The E-UTRAN PCell DRX configuration parameters are given in Table A.5.5.2.1.1-5 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.2-1. In the test there are two cells: Cell1 and Cell2. Cell1 is LTE PCell on  and Cell2 is NR FR2 PSCell. The test consists of one time period, with duration of T1. During T1, NR PSCell is continuously scheduled in DL while LTE PCell is not scheduled and has DRX configured. Prior to the start of the time duration T1, Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. Prior to start of T1 the DRX inactivity timer for the LTE PCell have already expired. During T1 the UE shall be continuously scheduled on NR PSCell while not scheduled on LTE PCell. PDCCH indicating a new transmission on PSCell shall be sent continuously during the whole time duration to ensure UE would not enter DRX state on PSCell.

**Table A.5.5.2.1.1-1: Interruption at transitions between active and non-active during DRX supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

**Table A.5.5.2.1.1-2: General test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF Channel Number | | 1, 2 | One is E-UTRAN RF channel and the other is NR RF channel |
| Active PCell | | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell | | Cell2 | PSCell on NR RF channel number 2. |
| CP length | | Normal | Applicable to cell1 and cell 2 |
| DRX | | ON | DRX related parameters are defined in Table A.5.5.2.1.1-3 |
| Measurement gap pattern Id | | OFF | |
| T1 | s | 10 | |

**Table A.5.5.2.1.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC**

| Parameter | | Unit | Cell 2 |
|---|---|---|---|
| Connection Type | | | Conducted |
| Frequency Range | | | FR2 |
| Duplex mode | Config 1,2 | | TDD |
| TDD configuration | Config 1,2 | | TBD |
| $BW_{channel}$ | Config 1,2 | MHz | 100: $N_{RB,c}$ = 66 |
| Initial BWP Configuration | Config 1,2 | | TBD |
| PDSCH Reference measurement channel | Config 1,2 | | SR.3.1 TDD |
| RMSI CORESET parameters | Config 1,2 | | CR.3.1 TDD |
| PDCCH CORESET parameters | Config 1,2 | | TBD |
| OCNG Patterns | | | OP.1 |
| SMTC Configuration | Config 1,2 | | SMTC.1 FR2 |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | |
| EPRE ratio of PDSCH to PDSCH | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| $\hat{E}_s/N_{oc}$ | | dB | TBD<br>TBD |
| Propagation Condition | | | AWGN |
| Time offset to cell1 Note 2 | | µs | 3 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells | | | |

**Table A.5.5.2.1.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC**

| Parameter | | Unit | Cell 2 |
|---|---|---|---|
| UE orientation around TBD axis and TBD axis | | | TBD |
| Relative difference in angle of arrival of cell 2 relative to cell 1 | | degrees | TBD |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/15kHz Note4 | TBD |
| | NR_TDD_FR2_B | | |
| | NR_TDD_FR2_C | | |
| | NR_TDD_FR2_D | | |
| | NR_TDD_FR2_E | | |
| | NR_TDD_FR2_F | | |
| | NR_TDD_FR2_G | | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/SCS Note3 | TBD |
| | NR_TDD_FR2_B | | |
| | NR_TDD_FR2_C | | |
| | NR_TDD_FR2_D | | |
| | NR_TDD_FR2_E | | |
| | NR_TDD_FR2_F | | |
| | NR_TDD_FR2_G | | |
| SS-RSRP Note2 | NR_TDD_FR2_A | dBm/SCS Note4 | TBD |
| | NR_TDD_FR2_B | | |
| | NR_TDD_FR2_C | | |
| | NR_TDD_FR2_D | | |
| | NR_TDD_FR2_E | | |
| | NR_TDD_FR2_F | | |
| | NR_TDD_FR2_G | | |

| | | | |
|---|---|---|---|
| $\hat{E}_s / I_{ot}$ | | dB | TBD |
| Io[Note2] | NR_TDD_FR2_A | dBm/95.04 MHz [Note4] | TBD |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 4: Equivalent power received by an antenna with 0dBi gain at the center of the quiet zone<br>Note 5: As observed with 0dBi gain antenna at the center of the quiet zone | | | |

**Table A.5.5.2.1.1-5: E-UTRAN PCell DRX-Configuration for E-UTRAN TDD – NR FR2 TDD interruptions at transitions between active and non-active during DRX in synchronous EN-DC**

| Field | Cell1 | Comment |
|---|---|---|
| | Value | |
| onDurationTimer | psf1 | As specified in clause 6.3.2 in TS 36.331 |
| drx-InactivityTimer[Note 1] | psf1 | |
| drx-RetransmissionTimer | psf1 | |
| longDRX-CycleStartOffset | Sf160 | |
| shortDRX | disable | |
| Note 1: UE is continuously scheduled in NR PSCell | | |

### A.5.5.2.1.2 Test Requirements

The UE shall be continuously scheduled in NR PSCell during the entire length of T1. UE shall not be scheduled in LTE PCell during T1. During the time duration T1 the UE shall transmit at least 99% of ACK/NACK on NR PSCell.

Interruption on NR PSCell shall not exceed 0.625ms (5 slots) as defined in section 8. 2.1.

The rate of correct events observed during repeated tests shall be at least 90%.

## A.5.5.2.2 E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

### A.5.5.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that when LTE PCell is in DRX and NR PSCell is in non-DRX, NR PSCell interruptions due to transitions from active to non-active and from non-active to active during LTE PCell DRX the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in section 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.2.1-1.

The general test parameters are given in Table A.5.5.2.2.1-2, and NR cell specific test parameters are given in Table A.5.5.2.2.1-3 and A.5.5.2.2.1-4. The E-UTRAN PCell DRX configuration parameters are given in Table A.5.5.2.2.1-5 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.2-1. In the test there are two cells: Cell1 and Cell2. Cell1 is LTE PCell and Cell2 is NR PSCell. The test consists of one time period, with duration of T1. During T1, NR PSCell is continuously scheduled in DL while LTE PCell is not scheduled and has DRX configured. Prior to the start of the time duration T1, Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. Prior to start of T1 the DRX inactivity timer for the LTE PCell have already expired. During T1 the UE shall be continuously scheduled on NR PSCell while not scheduled on LTE PCell. PDCCH indicating a new transmission on PSCell shall be sent continuously during the whole time duration to ensure UE would not enter DRX state on PSCell.

**Table A.5.5.2.2.1-1: Interruption at transitions between active and non-active during DRX supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

**Table A.5.5.2.2.1-2: General test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF Channel Number | | 1, 2 | One is E-UTRAN RF channel and the other is NR RF channel |
| Active PCell | | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell | | Cell2 | PSCell on NR RF channel number 2. |
| CP length | | Normal | Applicable to cell1 and cell 2 |
| DRX | | ON | DRX related parameters are defined in Table A.5.5.2.2.1-3 |
| Measurement gap pattern Id | | OFF | |
| T1 | s | 10 | |

**Table A.5.5.2.2.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC**

| Parameter | | Unit | Cell 2 |
|---|---|---|---|
| Connection Type | | | Conducted |
| Frequency Range | | | FR2 |
| Duplex mode | Config 1,2 | | TDD |
| TDD configuration | Config 1,2 | | TBD |
| $BW_{channel}$ | Config 1,2 | MHz | 100: $N_{RB,c}$ = 66 |
| Initial BWP Configuration | Config 1,2 | | TBD |
| PDSCH Reference measurement channel | Config 1,2 | | SR.3.1 TDD |
| RMSI CORESET parameters | Config 1,2 | | CR.3.1 TDD |
| PDCCH CORESET parameters | Config 1,2 | | TBD |
| OCNG Patterns | | | OP.1 |
| SMTC Configuration | Config 1,2 | | SMTC.1 FR2 |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | |
| EPRE ratio of PDSCH to PDSCH | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| $\hat{E}_s/N_{oc}$ | | dB | TBD<br>TBD |
| Propagation Condition | | | AWGN |
| Time offset to cell1 Note 2 | | ms | 3 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells | | | |

**Table A.5.5.2.1.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC**

| Parameter | | Unit | Cell 2 |
|---|---|---|---|
| UE orientation around TBD axis and TBD axis | | | TBD |
| Relative difference in angle of arrival of cell 2 relative to cell 1 | | degrees | TBD |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/15kHz Note4 | TBD |
| | NR_TDD_FR2_B | | |
| | NR_TDD_FR2_C | | |
| | NR_TDD_FR2_D | | |
| | NR_TDD_FR2_E | | |
| | NR_TDD_FR2_F | | |
| | NR_TDD_FR2_G | | |

| | | | |
|---|---|---|---|
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/SCS Note3 | TBD |
| | NR_TDD_FR2_B | | |
| | NR_TDD_FR2_C | | |
| | NR_TDD_FR2_D | | |
| | NR_TDD_FR2_E | | |
| | NR_TDD_FR2_F | | |
| | NR_TDD_FR2_G | | |
| SS-RSRP Note2 | NR_TDD_FR2_A | dBm/SCS Note4 | TBD |
| | NR_TDD_FR2_B | | |
| | NR_TDD_FR2_C | | |
| | NR_TDD_FR2_D | | |
| | NR_TDD_FR2_E | | |
| | NR_TDD_FR2_F | | |
| | NR_TDD_FR2_G | | |
| $\hat{E}_s / I_{ot}$ | | dB | TBD |
| Io Note2 | NR_TDD_FR2_A | dBm/95.04 MHz Note4 | TBD |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 4: Equivalent power received by an antenna with 0dBi gain at the center of the quiet zone<br>Note 5: As observed with 0dBi gain antenna at the center of the quiet zone | | | |

**Table A.5.5.2.2.1-5: E-UTRAN PCell DRX-Configuration for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC**

| Field | Cell1 | Comment |
|---|---|---|
| | Value | |
| onDurationTimer | psf1 | As specified in clause 6.3.2 in TS 36.331 |
| drx-InactivityTimer Note 1 | psf1 | |
| drx-RetransmissionTimer | psf1 | |
| longDRX-CycleStartOffset | Sf320 | |
| shortDRX | disable | |
| Note 1: UE is continuously scheduled in NR PSCell | | |

### A.5.5.2.2.2 Test Requirements

The UE shall be continuously scheduled in NR PSCell during the entire length of T1. UE shall not be scheduled in LTE PCell during T1. During the time duration T1 the UE shall transmit at least 99% of ACK/NACK on NR PSCell.

Interruption on NR PSCell shall not exceed 0.625ms (5 slots) as defined in section 8. 2.1.

The rate of correct events observed during repeated tests shall be at least 90%.

## A.5.5.2.3 E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

### A.5.5.2.3.1 Test Purpose and Environment

The purpose of this test is to verify NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in section 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.3.1-1.

The general test parameters are given in Table A.5.5.2.3.1-2, and NR cell specific test parameters are given in Table A.5.5.2.3.1-3 and A.5.5.2.3.1-4 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-2. In the test there are three cells: Cell1 Cell2 and Cell3. Cell1 is LTE PCell, Cell2 and Cell 3 is NR FR2 PSCell and NR FR2 deactivated SCell. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received by the UE, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

**Table A.5.5.2.3.1-1: Interruption during measurements on deactivated NR SCC supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

**Table A.5.5.2.3.1-2: General test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF Channel Number | | 1, 2 | One is E-UTRAN RF channel and the other two are NR RF channel |
| Active PCell | | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell | | Cell2 | PSCell on NR RF channel number 2. |
| Configured deactivated SCell | | Cell3 | Deactivated SCell on NR RF channel number 2. |
| CP length | | Normal | Applicable to cell1, cell 2 and cell3 |
| DRX | | OFF | |
| Measurement gap pattern Id | | OFF | |
| SCell measurement cycle (measCycleSCell) | ms | 640 | |
| T1 | s | 10 | |

**Table A.5.5.2.3.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC**

| Parameter | | Unit | Cell 2 | Cell 3 |
|---|---|---|---|---|
| Connection Type | | | Conducted | Conducted |
| Frequency Range | | | FR2 | FR2 |
| Duplex mode | Config 1 | | FDD | FDD |
| | Config 2 | | TDD | TDD |
| TDD configuration | Config 1 | | N.A | N.A |
| | Config 2 | | TBD | TBD |
| $BW_{channel}$ | Config 1,2 | MHz | 100: $N_{RB,c}$ = 66 | 100: $N_{RB,c}$ = 66 |
| Initial BWP Configuration | Config 1,2 | | TBD | TBD |
| PDSCH Reference measurement channel | Config 1,2 | | SR.3.1 TDD | - |
| RMSI CORESET parameters | Config 1,2 | | CR.3.1 TDD | CR.3.1 TDD |
| PDCCH CORESET parameters | Config 1,2 | | TBD | TBD |
| OCNG Patterns | | | OP.1 | OP.1 |
| SMTC Configuration | Config 1,2 | | SMTC.1 FR2 | SMTC.1 FR2 |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | |
| $\hat{E}_s/N_{oc}$ | | dB | TBD | TBD |
| Propagation Condition | | | AWGN | AWGN |
| Time offset to cell1 Note 2 | | µs | 3 | 3 |
| Time offset to cell1 Note 3 | | µs | - | 3 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells<br>Note 3: Receive time difference of signals received between slot timing boundary from two NR Cells including time alignment error between the two cells | | | | |

**Table A.5.5.2.3.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC**

| Parameter | | Unit | Cell 2 | Cell 3 |
|---|---|---|---|---|
| UE orientation around TBD axis and TBD axis | | | TBD | |
| Relative difference in angle of arrival of cell 2 and cell 3 relative to cell 1 | | degrees | TBD | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/15kHz Note4 | TBD | TBD |
| | NR_TDD_FR2_B | | | |
| | NR_TDD_FR2_C | | | |
| | NR_TDD_FR2_D | | | |
| | NR_TDD_FR2_E | | | |
| | NR_TDD_FR2_F | | | |
| | NR_TDD_FR2_G | | | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/SCS Note3 | TBD | TBD |
| | NR_TDD_FR2_B | | | |
| | NR_TDD_FR2_C | | | |
| | NR_TDD_FR2_D | | | |
| | NR_TDD_FR2_E | | | |
| | NR_TDD_FR2_F | | | |
| | NR_TDD_FR2_G | | | |
| SS-RSRP Note2 | NR_TDD_FR2_A | dBm/SCS Note4 | TBD | TBD |
| | NR_TDD_FR2_B | | | |
| | NR_TDD_FR2_C | | | |

| | | | | |
|---|---|---|---|---|
| | NR_TDD_FR2_D<br>NR_TDD_FR2_E<br>NR_TDD_FR2_F<br>NR_TDD_FR2_G | | | |
| $\hat{E}_s/I_{ot}$ | | dB | TBD | TBD |
| Io^Note2 | NR_TDD_FR2_A | dBm/95.04 MHz Note4 | TBD | TBD |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 4: Equivalent power received by an antenna with 0dBi gain at the center of the quiet zone<br>Note 5: As observed with 0dBi gain antenna at the center of the quiet zone | | | | |

#### A.5.5.2.3.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table A.5.5.2.3.2-1 and Table A.5.5.2.3.2-2.

**Table A.5.5.2.3.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell**

| $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 3 | 0.125 | 4 |

**Table A.5.5.2.3.2-2: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell**

| $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 3 | 0.125 | 8 + SMTC duration |

The rate of correct events observed during repeated tests shall be at least 90%.

### A.5.5.2.4 E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

#### A.5.5.2.4.1 Test Purpose and Environment

The purpose of this test is to verify NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in section 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.4.1-1.

The general test parameters are given in Table A.5.5.2.4.1-2, and NR cell specific test parameters are given in Table A.5.5.2.4.1-3 and A.5.5.2.4.1-4 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-2. In the test there are three cells: Cell1 Cell2 and Cell3. Cell1 is LTE PCell, Cell2 and Cell 3 is NR FR2 PSCell and NR FR2 deactivated SCell. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received by the UE, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

**Table A.5.5.2.4.1-1: Interruption during measurements on deactivated NR SCC supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

**Table A.5.5.2.4.1-1: General test parameters for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in asynchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF Channel Number | | 1, 2 | One is E-UTRAN RF channel and the other two are NR RF channel |
| Active PCell | | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell | | Cell2 | PSCell on NR RF channel number 2. |
| Configured deactivated SCell | | Cell3 | Deactivated SCell on NR RF channel number 2. |
| CP length | | Normal | Applicable to cell1, cell 2 and cell3 |
| AoA number | | 1 | Applicable to cell2 and cell3 |
| DRX | | OFF | |
| Measurement gap pattern Id | | OFF | |
| SCell measurement cycle (measCycleSCell) | ms | 640 | |
| T1 | s | 10 | |

**Table A.5.5.2.3.1-2: NR cell specific test parameters for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in asynchronous EN-DC**

| Parameter | | Unit | Cell 2 | Cell 3 |
|---|---|---|---|---|
| Connection Type | | | Conducted | Conducted |
| Frequency Range | | | FR2 | FR2 |
| Duplex mode | Config 1 | | FDD | FDD |
| | Config 2 | | TDD | TDD |
| TDD configuration | Config 1 | | N.A | N.A |
| | Config 2 | | TBD | TBD |
| $BW_{channel}$ | Config 1,2 | MHz | 100: $N_{RB,c}$ = 66 | 100: $N_{RB,c}$ = 66 |
| Initial BWP Configuration | Config 1,2 | | TBD | TBD |
| PDSCH Reference measurement channel | Config 1,2 | | SR.3.1 TDD | - |
| RMSI CORESET parameters | Config 1,2 | | CR.3.1 TDD | CR.3.1 TDD |
| PDCCH CORESET parameters | Config 1,2 | | TBD | TBD |
| OCNG Patterns | | | OP.1 | OP.1 |
| SMTC Configuration | Config 1,2 | | SMTC.1 FR2 | SMTC.1 FR2 |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | |
| $\hat{E}_s/N_{oc}$ | | dB | TBD | TBD |
| Propagation Condition | | | AWGN | AWGN |
| Time offset to cell1 Note 2 | | ms | 3 | 3 |
| Time offset to cell1 Note 3 | | μs | - | 3 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells<br>Note 3: Receive time difference of signals received between slot timing boundary from two NR Cells including time alignment error between the two cells | | | | |

**Table A.5.5.2.4.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC**

| Parameter | | Unit | Cell 2 | Cell 3 |
|---|---|---|---|---|
| UE orientation around TBD axis and TBD axis | | | TBD | |
| Relative difference in angle of arrival of cell 2 and cell 3 relative to cell 1 | | degrees | TBD | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/15kHz Note4 | TBD | TBD |
| | NR_TDD_FR2_B | | | |
| | NR_TDD_FR2_C | | | |
| | NR_TDD_FR2_D | | | |
| | NR_TDD_FR2_E | | | |
| | NR_TDD_FR2_F | | | |
| | NR_TDD_FR2_G | | | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/SCS Note3 | TBD | TBD |
| | NR_TDD_FR2_B | | | |
| | NR_TDD_FR2_C | | | |
| | NR_TDD_FR2_D | | | |
| | NR_TDD_FR2_E | | | |
| | NR_TDD_FR2_F | | | |
| | NR_TDD_FR2_G | | | |
| SS-RSRP Note2 | NR_TDD_FR2_A | dBm/SCS Note4 | TBD | TBD |
| | NR_TDD_FR2_B | | | |
| | NR_TDD_FR2_C | | | |

| | | | | |
|---|---|---|---|---|
| | NR_TDD_FR2_D<br>NR_TDD_FR2_E<br>NR_TDD_FR2_F<br>NR_TDD_FR2_G | | | |
| $\hat{E}_s/I_{ot}$ | | dB | TBD | TBD |
| Io[Note2] | NR_TDD_FR2_A | dBm/95.04 MHz Note4 | TBD | TBD |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 4: Equivalent power received by an antenna with 0dBi gain at the center of the quiet zone<br>Note 5: As observed with 0dBi gain antenna at the center of the quiet zone | | | | |

#### A.5.5.2.4.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table A.5.5.2.4.2-1 and Table A.5.5.2.4.2-2.

**Table A.5.5.2.4.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell**

| $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 3 | 0.125 | 4 |

**Table A.5.5.2.4.2-2: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell**

| $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 3 | 0.125 | 8 + SMTC duration |

The rate of correct events observed during repeated tests shall be at least 90%.

### A.5.5.2.5 E-UTRAN – NR FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

#### A.5.5.2.5.1 Test Purpose and Environment

The purpose of this test is to verify NR PSCell interruptions during the measurement on the deactivated E-UTRAN SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in section 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.5.1-1.

The general test parameters are given in Table A.5.5.2.5.1-2, and NR cell specific test parameters are given in Table A.5.5.2.5.1-3 and A.5.5.2.5.1-4 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-2. In the test there are three cells: Cell1 Cell2 and Cell3. Cell1 and Cell3 is LTE PCell and LTE deactivated SCell, Cell2 is NR FR2 PSCell. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received by the UE, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

**Table A.5.5.2.5.1-1: Interruption during measurements on deactivated E-UTRAN SCC supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

**Table A.5.5.2.5.1-2: General test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E_UTRAN SCC in synchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF Channel Number | | 1, 2 | One is E-UTRAN RF channel and the other two are NR RF channel |
| Active PCell | | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell | | Cell2 | PSCell on NR RF channel number 2. |
| Configured deactivated SCell | | Cell3 | Deactivated SCell on NR RF channel number 2. |
| CP length | | Normal | Applicable to cell1, cell 2 and cell3 |
| DRX | | OFF | |
| Measurement gap pattern Id | | OFF | |
| SCell measurement cycle (measCycleSCell) | ms | 640 | |
| T1 | s | 10 | |

**Table A.5.5.2.5.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E_UTRAN SCC in synchronous EN-DC**

| Parameter | | Unit | Cell 2 |
|---|---|---|---|
| Connection Type | | | Conducted |
| Frequency Range | | | FR2 |
| Duplex mode | Config 1,2 | | TDD |
| TDD configuration | Config 1,2 | | TBD |
| $BW_{channel}$ | Config 1,2 | MHz | 100: $N_{RB,c}$ = 66 |
| Initial BWP Configuration | Config 1,2 | | TBD |
| PDSCH Reference measurement channel | Config 1,2 | | SR.3.1 TDD |
| RMSI CORESET parameters | Config 1,2 | | CR.3.1 TDD |
| PDCCH CORESET parameters | Config 1,2 | | TBD |
| OCNG Patterns | | | OP.1 |
| SMTC Configuration | Config 1,2 | | SMTC.1 FR2 |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | |
| EPRE ratio of PDSCH to PDSCH | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| $\hat{E}_s/N_{oc}$ | | dB | TBD |
| Propagation Condition | | | AWGN |
| Time offset to cell1 Note 2 | | µs | 3 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells | | | |

**Table A.5.5.2.5.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E_UTRAN SCC in synchronous EN-DC**

| Parameter | | Unit | Cell 2 |
|---|---|---|---|
| UE orientation around TBD axis and TBD axis | | | TBD |
| Relative difference in angle of arrival of cell 2 relative to cell 1 | | degrees | TBD |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/15kHz Note4 | TBD |
| | NR_TDD_FR2_B | | |
| | NR_TDD_FR2_C | | |
| | NR_TDD_FR2_D | | |
| | NR_TDD_FR2_E | | |
| | NR_TDD_FR2_F | | |
| | NR_TDD_FR2_G | | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/SCS Note3 | TBD |
| | NR_TDD_FR2_B | | |
| | NR_TDD_FR2_C | | |
| | NR_TDD_FR2_D | | |
| | NR_TDD_FR2_E | | |
| | NR_TDD_FR2_F | | |
| | NR_TDD_FR2_G | | |
| SS-RSRP Note2 | NR_TDD_FR2_A | dBm/SCS Note4 | TBD |
| | NR_TDD_FR2_B | | |
| | NR_TDD_FR2_C | | |
| | NR_TDD_FR2_D | | |
| | NR_TDD_FR2_E | | |
| | NR_TDD_FR2_F | | |
| | NR_TDD_FR2_G | | |
| $\hat{E}_s/I_{ot}$ | | dB | TBD |
| Io Note2 | NR_TDD_FR2_A | dBm/95.04 MHz Note4 | TBD |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 4: Equivalent power received by an antenna with 0dBi gain at the center of the quiet zone<br>Note 5: As observed with 0dBi gain antenna at the center of the quiet zone | | | |

### A.5.5.2.5.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table A.5.5.2.5.2-1 and Table A.5.5.2.5.2-2.

**Table A.5.5.2.5.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell**

| $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 3 | 0.125 | 5 |

**Table A.5.5.2.5.2-2: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell**

| $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 3 | 0.125 | 4 + SMTC duration |

The rate of correct events observed during repeated tests shall be at least 90%.

### A.5.5.2.6 E-UTRAN – NR FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

#### A.5.5.2.6.1 Test Purpose and Environment

The purpose of this test is to verify NR PSCell interruptions during the measurement on the deactivated E-UTRAN SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in section 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.6.1-1.

The general test parameters are given in Table A.5.5.2.6.1-2, and NR cell specific test parameters are given in Table A.5.5.2.6.1-3 and A.5.5.2.6.1-4 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-2. In the test there are three cells: Cell1 Cell2 and Cell3. Cell1 and Cell3 is LTE PCell and LTE deactivated SCell, Cell2 is NR FR2 PSCell. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received by the UE, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

**Table A.5.5.2.6.1-1: Interruption during measurements on deactivated E-UTRAN SCC supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

**Table A.5.5.2.6.1-2: General test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E_UTRAN SCC in asynchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF Channel Number | | 1, 2 | One is E-UTRAN RF channel and the other two are NR RF channel |
| Active PCell | | Cell1 | PCell on E-UTRAN RF channel number 1. |
| Configured PSCell | | Cell2 | PSCell on NR RF channel number 2. |
| Configured deactivated SCell | | Cell3 | Deactivated SCell on NR RF channel number 2. |
| CP length | | Normal | Applicable to cell1, cell 2 and cell3 |
| DRX | | OFF | |
| Measurement gap pattern Id | | OFF | |
| SCell measurement cycle (measCycleSCell) | ms | 640 | |
| T1 | s | 10 | |

**Table A.5.5.2.6.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E_UTRAN SCC in asynchronous EN-DC**

| Parameter | | Unit | Cell 2 |
|---|---|---|---|
| Connection Type | | | Conducted |
| Frequency Range | | | FR2 |
| Duplex mode | Config 1,2 | | TDD |
| TDD configuration | Config 1,2 | | TBD |
| $BW_{channel}$ | Config 1,2 | MHz | 100: $N_{RB,c}$ = 66 |
| Initial BWP Configuration | Config 1,2 | | TBD |
| PDSCH Reference measurement channel | Config 1,2 | | SR.3.1 TDD |
| RMSI CORESET parameters | Config 1,2 | | CR.3.1 TDD |
| PDCCH CORESET parameters | Config 1,2 | | TBD |
| OCNG Patterns | | | OP.1 |
| SMTC Configuration | Config 1,2 | | SMTC.1 FR2 |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | |
| EPRE ratio of PDSCH to PDSCH | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| $\hat{E}_s/N_{oc}$ | | dB | TBD |
| Propagation Condition | | | AWGN |
| Time offset to cell1 Note 2 | | ms | 3 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells | | | |

**Table A.5.5.2.6.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E_UTRAN SCC in asynchronous EN-DC**

| Parameter | | Unit | Cell 2 |
|---|---|---|---|
| UE orientation around TBD axis and TBD axis | | | TBD |
| Relative difference in angle of arrival of cell 2 relative to cell 1 | | degrees | TBD |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/15kHz Note4 | TBD |
| | NR_TDD_FR2_B | | |
| | NR_TDD_FR2_C | | |
| | NR_TDD_FR2_D | | |
| | NR_TDD_FR2_E | | |
| | NR_TDD_FR2_F | | |
| | NR_TDD_FR2_G | | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/SCS Note3 | TBD |
| | NR_TDD_FR2_B | | |
| | NR_TDD_FR2_C | | |
| | NR_TDD_FR2_D | | |
| | NR_TDD_FR2_E | | |
| | NR_TDD_FR2_F | | |
| | NR_TDD_FR2_G | | |
| SS-RSRP Note2 | NR_TDD_FR2_A | dBm/SCS Note4 | TBD |
| | NR_TDD_FR2_B | | |
| | NR_TDD_FR2_C | | |
| | NR_TDD_FR2_D | | |
| | NR_TDD_FR2_E | | |
| | NR_TDD_FR2_F | | |
| | NR_TDD_FR2_G | | |

| | | | |
|---|---|---|---|
| $\hat{E}_s/I_{ot}$ | | dB | TBD |
| Io Note2 | NR_TDD_FR2_A | dBm/95.04 MHz Note4 | TBD |

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0dBi gain at the center of the quiet zone
Note 5: As observed with 0dBi gain antenna at the center of the quiet zone

#### A.5.5.2.6.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table A.5.5.2.6.2-1 and Table A.5.5.2.6.2-2.

**Table A.5.5.2.6.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell**

| $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 3 | 0.125 | 5 |

**Table A.5.5.2.6.2-2: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell**

| $\mu$ | NR Slot length (ms) | Interruption length |
|---|---|---|
| 3 | 0.125 | 4 + SMTC duration |

The rate of correct events observed during repeated tests shall be at least 90%.

## A.5.5.3 SCell Activation and Deactivation Delay

### A.5.5.3.1 SCell Activation and deactivation of SCell in FR2 intra-band in non-DRX

#### A.5.5.3.1.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in section A.4.5.3.1.1 except the SCell is in FR2 intra-band.

The supported test configurations are shown in table A.5.5.3.1.1-1 below. The general and cell specific test parameters are the same except those described in the following section. The listed parameter values in Tables A.5.5.3.1.1-2 and A.5.5.3.1.1-3 will replace the values of corresponding parameters in Tables A.4.5.3.1.1-1 and A.4.5.3.1.1-2. In this case, OTA related test parameters are shown in table A.5.5.3.1.1-4 below.

**Table A.5.5.3.1.1-1: Supported test configurations for FR2 SCell activation case**

| Configuration | Description |
|---|---|
| 1 | FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

Note: The UE is only required to pass in one of the supported test configurations

### Table A.5.5.3.1.1-2: General test parameters for FR2 SCell activation case

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| Active PCell | | Cell 1 | Primary cell on E-UTRAN RF channel number 1.<br>As specified in section A.3.7.2.2 |

### Table A.5.5.3.1.1-3: Cell specific test parameters for FR2 SCell activation case

| Parameter Note 5 | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|
| | | Cell 2 | Cell 3 | Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| SSB ARFCN | | freq2 | | freq2 | | freq2 | |
| Duplex mode | | TDD | | TDD | | TDD | |
| TDD configuration | | TDDConf.3.1 | | TDDConf.3.1 | | TDDConf.3.1 | |
| $BW_{channel}$ | MHz | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| PDSCH Reference measurement channel | | SR.3.1 TDD | - | SR.3.1 TDD | - | SR.3.1 TDD | - |
| RMSI CORESET Reference Channel | | CR.3.1 TDD | - | CR.3.1 TDD | - | CR.3.1 TDD | - |
| OCNG Patterns | | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 |
| SMTC configuration | | SMTC. 1 FR2 | SMTC. 1 FR2 | SMTC. 1 FR2 | SMTC. 1 FR2 | SMTC. 1 FR2 | SMTC. 1 FR2 |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | 120 | 120 | 120 | 120 | 120 |
| EPRE ratio of PSS to SSS | dB | 0 | | | | | |
| EPRE ratio of PBCH_DMRS to SSS | | | | | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | | | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | | | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | | | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | | | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS Note 1 | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 | | | | | | | |
| $\hat{E}_s/N_{oc}$ | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| Propagation conditions | | AWGN | | | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 5: All parameters apply for configuration 1 and 2 | | | | | | | |

### Table A.5.5.3.1.1-4: OTA related test parameters for FR2 SCell activation case

| Parameter Note 6 | | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|---|
| | | | Cell 2 | Cell 3 | Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| Angle of arrival configuration | | | According to table A.X.X | | According to table A.X.X | | According to table A.X.X | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/15kHz Note4 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| | NR_TDD_FR2_A | dBm/SCS Note 3 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $N_{oc}$ Note1 | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| SS-RSRP Note2 | NR_TDD_FR2_A | dBm/SCS Note4 | TBD | TBD | TBD | TBD | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD | TBD |
| | NR_TDD_FR2_F | | | | | | TBD | TBD |
| | NR_TDD_FR2_G | | | | | | TBD | TBD |
| | NR_TDD_FR2_T | | | | | | TBD | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| Io Note2 | NR_TDD_FR2_A | dBm/95.04 MHz Note4 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 6: All parameters apply for configuration 1 and 2

#### A.5.5.3.1.2 Test Requirements

The test requirements defined in section A.4.5.3.1.2 shall apply to this test case, except $T_{activation\_time}$ will be replaced with the value [3ms+TBD] as defined in section 8.3.

## A.5.5.4 UE UL carrier RRC reconfiguration Delay

## A.5.5.5 Beam Failure Detection and Link recovery procedures

### A.5.5.5.1 EN-DC Beam Failure Detection and Link Recovery Test for FR2 PSCell configured with SSB-based BFD and LR in non-DRX mode

*Editor's note: It is open whether BFD can be based on SSB. This test case will be updated accordingly.*

#### A.5.5.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set $q_0$ configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candicate set $q_1$. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.5.5.5.1.1-1, A.5.5.5.1.1-2, A.5.5.5.1.1-3 and A.5.5.5.1.1-4 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.1.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB in set $q_0$ in the active PSCell to emulate SSB based beam failure. Figure A.5.5.5.1.1-1 additionally shows the variation of the downlink SNR of the SSB in set $q_1$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 2.

**Table A.5.5.5.1.1-1: Supported test configurations for FR2 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100MHz bandwidth |
| 2 | LTE TDD, TDD duplex mode, 240 kHz SSB SCS, 100MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

**Table A.5.5.5.1.1-2: General test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode**

| Parameter | | Unit | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active E-UTRA PCell | | | Cell 1 | Cell 1 | |
| E-UTRA RF Channel Number | | | 1 | 1 | |
| Active PCell | | | Cell 2 | Cell 2 | |
| RF Channel Number | | | 2 | 2 | |
| Duplex mode | Config 1 | | TDD | TDD | |
| | Config 2 | | TDD | TDD | |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] | |
| | Config 2 | | [TDDConf.3.1] | [TDDConf.3.1] | |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] | |
| | Config 2 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] | |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| | Config 2 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| SMTC Configuration | Config 1 | | TDD | TDD | |
| | Config 2 | | TDD | TDD | |
| PDSCH/ PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz | |
| | Config 2 | | 120 KHz | 120 KHz | |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] | |
| OCNG parameters | | | TBD | TBD | |
| CP length | | | Normal | Normal | |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] | |
| Beam failure detection transmission parameters | DCI format | | 1-0 | 1-0 | |
| | Number of Control OFDM symbols | | 2 | 2 | |
| | Aggregation level | CCE | 8 | 8 | |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | DMRS precoder granularity | | REG bundle size | REG bundle size | |
| | REG bundle size | | 6 | 6 | |
| DRX | | | OFF | OFF | |
| Gap pattern ID | | | [N.A.] | *[*gp0*] | |

| | | | | | |
|---|---|---|---|---|---|
| ssb-Index | | | 2 | 2 | Number of SSB indexes used for beam failure detection |
| rlmInSyncOutOfSync Threshold | | | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | | TBD | TBD | Threshold used for $Q_{out\_LR\_SSB}$ |
| powerControlOffsetSS | | | NA | NA | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstance MaxCount | | | [n2] | [n2] | see TS 38.321 [7], section 5.17 |
| beamFailureDetection Timer | | | [pbfd4] | [pbfd4] | see TS 38.321 [7], section 5.17 |
| ZP CSI-RS configuation | | | TBD | TBD | |
| CSI-IM configuration | | | TBD | TBD | |
| Periodic CSI reporting | | | PUCCH | PUCCH | |
| CSI reporting periodicity | Config 1 | slot | [5] | [5] | |
| | Config 2 | | [10] | [10] | |
| T1 | | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | s | 0.4 | 0.4 | |
| T3 | | s | [0.6] | [0.6] | |
| D1 | | s | [0.24] | [0.44] | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

**Table A.5.5.5.1.1-3: Cell specific test parameters for FR2 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode**

| Parameter | | Unit | Test 1 and Test 2 | | | | | Test 1 and Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SSB of set $q_0$ | | | | | SSB of set $q_1$ | | | | |
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| PDCCH_beta | | dB | 4 | | | | | 4 | | | | |
| PDCCH_DMRS_beta | | dB | 4 | | | | | 4 | | | | |
| PBCH_beta | | dB | 0 | | | | | 0 | | | | |
| PSS_beta | | dB | | | | | | | | | | |
| SSS_beta | | dB | | | | | | | | | | |
| PDSCH_beta | | dB | | | | | | | | | | |
| OCNG_beta | | dB | | | | | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15K Hz | [-98] | | | | | [-98] | | | | |
| | Config 2 | | [-98] | | | | | [-98] | | | | |
| | Config 3 | | [-98] | | | | | [-98] | | | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | | | [TDL-C 300ns 100Hz] | | | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.5.1.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.5.5.5.1.1-4: Measurement gap configuration for FR2 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

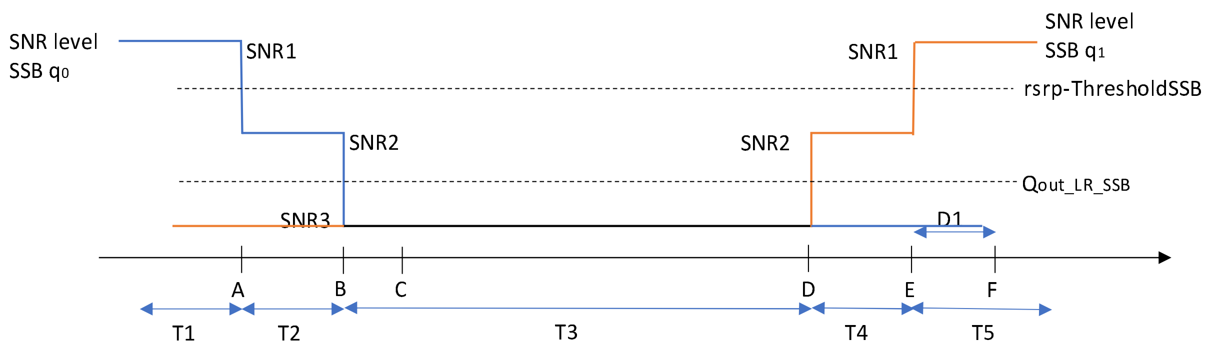


**Figure A.5.5.5.1.1-1: SNR variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode**

#### A.5.5.5.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_1$.

No later than time point F occurring no later than D1 = [TBD] ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set $q_1$.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

### A.5.5.5.2 EN-DC Beam Failure Detection and Link Recovery Test for FR2 PSCell configured with SSB-based BFD and LR in DRX mode

*Editor's note: It is open whether BFD can be based on SSB. This test case will be updated accordingly.*

#### A.5.5.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set $q_0$ configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candicate set $q_1$. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.5.5.5.2.1-1, A.5.5.5.2.1-2, A.5.5.5.2.1-3, A.5.5.5.2.1-4 and A.5.5.5.2.1-5 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.2.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB in set $q_0$ in the active PSCell to emulate SSB based beam failure. Figure A.5.5.5.2.1-1 additionally shows the variation of the downlink SNR of the SSB in set $q_1$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is enabled in PCSell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 2.

**Table A.5.5.5.2.1-1: Supported test configurations for FR2 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100MHz bandwidth |
| 2 | LTE TDD, TDD duplex mode, 240 kHz SSB SCS, 100MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

**Table A.5.5.5.2.1-2: General test parameters for FR2 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode**

| Parameter | | Unit | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active E-UTRA PCell | | | Cell 1 | Cell 1 | |
| E-UTRA RF Channel Number | | | 1 | 1 | |
| Active PCell | | | Cell 2 | Cell 2 | |
| RF Channel Number | | | 2 | 2 | |
| Duplex mode | Config 1 | | TDD | TDD | |
| | Config 2 | | TDD | TDD | |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] | |
| | Config 2 | | [TDDConf.3.1] | [TDDConf.3.1] | |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] | |
| | Config 2 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] | |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| | Config 2 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| SMTC Configuration | Config 1 | | TDD | TDD | |
| | Config 2 | | TDD | TDD | |
| PDSCH/ PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz | |
| | Config 2 | | 120 KHz | 120 KHz | |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] | |
| OCNG parameters | | | TBD | TBD | |
| CP length | | | Normal | Normal | |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] | |
| Beam failure detection transmission parameters | DCI format | | 1-0 | 1-0 | |
| | Number of Control OFDM symbols | | 2 | 2 | |
| | Aggregation level | CCE | 8 | 8 | |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | DMRS precoder granularity | | REG bundle size | REG bundle size | |
| | REG bundle size | | 6 | 6 | |
| DRX | | | 640 | 640 | |
| Gap pattern ID | | | [N.A.] | *[*gp0*] | |

| | | | | | |
|---|---|---|---|---|---|
| ssb-Index | | | 2 | 2 | Number of SSB indexes used for beam failure detection |
| rlmInSyncOutOfSync Threshold | | | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | | TBD | TBD | Threshold used for $Q_{out\_LR\_SSB}$ |
| powerControlOffsetSS | | | NA | NA | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstance MaxCount | | | [n2] | [n2] | see TS 38.321 [7], section 5.17 |
| beamFailureDetection Timer | | | [pbfd4] | [pbfd4] | see TS 38.321 [7], section 5.17 |
| ZP CSI-RS configuation | | | TBD | TBD | |
| CSI-IM configuration | | | TBD | TBD | |
| Periodic CSI reporting | | | PUCCH | PUCCH | |
| CSI reporting periodicity | Config 1, 2 | slot | [5] | [5] | |
| | Config 3 | | [10] | [10] | |
| T1 | | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | s | 0.4 | 0.4 | |
| T3 | | s | [0.6] | [0.6] | |
| D1 | | s | [0.24] | [0.44] | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

**Table A.5.5.5.2.1-3: Cell specific test parameters for FR2 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode**

| Parameter | | Unit | Test 1 and Test 2 | | | | | Test 1 and Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SSB of set $q_0$ | | | | | SSB of set $q_1$ | | | | |
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| PDCCH_beta | | dB | 4 | | | | | 4 | | | | |
| PDCCH_DMRS_beta | | dB | 4 | | | | | 4 | | | | |
| PBCH_beta | | dB | 0 | | | | | 0 | | | | |
| PSS_beta | | dB | | | | | | | | | | |
| SSS_beta | | dB | | | | | | | | | | |
| PDSCH_beta | | dB | | | | | | | | | | |
| OCNG_beta | | dB | | | | | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15K Hz | [-98] | | | | | [-98] | | | | |
| | Config 2 | | [-98] | | | | | [-98] | | | | |
| | Config 3 | | [-98] | | | | | [-98] | | | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | | | [TDL-C 300ns 100Hz] | | | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.5.2.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.5.5.5.2.1-4: Measurement gap configuration for FR2 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

**Table A.5.5.5.2.1-5: DRX-Configuration for FR2 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode.**

| Field | Test 5 | Test 6 |
|---|---|---|
| | Value | Value |
| drx-onDurationTimer | [ms6] | [ms6] |
| drx-InactivityTimer | [ms1] | [ms1] |
| drx-RetransmissionTimerDL | [sl1] | [sl1] |
| drx-RetransmissionTimerUL | [sl1] | [sl1] |
| longDRX-CycleStartOffset | [ms640] | [ms40] |
| shortDRX | disable | disable |

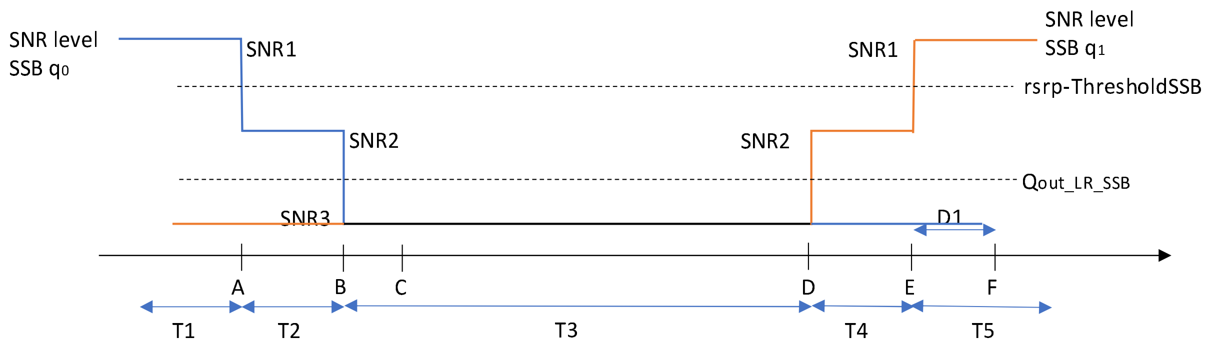


**Figure A.5.5.5.2.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in non-DRX mode**

#### A.5.5.5.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_1$.

No later than time point F occurring no later than D1 = [TBD] ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set $q_1$.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

### A.5.5.5.3 EN-DC Beam Failure Detection and Link Recovery Test for FR2 PSCell configured with CSI-RS-based BFD and LR in non-DRX mode

#### A.5.5.5.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set $q_0$ configured for a serving PSCell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set $q_1$. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.5.5.5.3.1-1, A.5.5.5.3.1-2, A.5.5.5.3.1-3, A.5.5.5.3.1-4 and A.5.5.5.3.1-5 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.3.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the CSI-RS in set $q_0$ in the active PSCell to emulate CSI-RS based beam failure. Figure A.5.5.5.3.1-1 additionally shows the variation of the downlink SNR of the CSI-RS in set $q_1$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 2.

**Table A.5.5.5.3.1-1: Supported test configurations for FR2 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100MHz bandwidth |

**Table A.5.5.5.3.1-2: General test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode**

| Parameter | | Unit | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active E-UTRA PCell | | | Cell 1 | Cell 1 | |
| E-UTRA RF Channel Number | | | 1 | 1 | |
| Active PCell | | | Cell 2 | Cell 2 | |
| RF Channel Number | | | 2 | 2 | |
| Duplex mode | Config 1 | | TDD | TDD | |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] | |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] | A.3.1.2 |
| SSB Configuration | Config 1 | | SSB.1 FR2 | SSB.1 FR2 | A.3.10 |
| SMTC Configuration | Config 1 | | SMTC.1 | SMTC.1 | A.3.11 |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz | |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] | |
| OCNG parameters | | | TBD | TBD | A.3.2.1 |
| CP length | | | Normal | Normal | |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] | |
| Beam failure detection trans mission parameters | DCI format | | 1-0 | 1-0 | |
| | Number of Control OFDM symbols | | 2 | 2 | |
| | Aggregation level | CCE | 8 | 8 | |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | DMRS precoder granularity | | REG bundle size | REG bundle size | |
| | REG bundle size | | 6 | 6 | |
| DRX | | | OFF | OFF | |
| Gap pattern ID | | | [N.A.] | *[*gp0*] | |

| | | | | | |
|---|---|---|---|---|---|
| csi-RS-Index | | | 2 | 2 | Number of SSB indexes used for beam failure detection |
| rlmInSyncOutOfSync Threshold | | | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | | TBD | TBD | Threshold used for $Q_{out\_LR\_SSB}$ |
| powerControlOffsetS S | | | NA | NA | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstance MaxCount | | | [n2] | [n2] | see TS 38.321 [7], section 5.17 |
| beamFailureDetection Timer | | | [pbfd4] | [pbfd4] | see TS 38.321 [7], section 5.17 |
| ZP CSI-RS configuation | | | TBD | TBD | |
| CSI-IM configuration | | | TBD | TBD | |
| Periodic CSI reporting | | | PUCCH | PUCCH | |
| CSI reporting periodicity | Config 1, 2 | slot | [5] | [5] | |
| | Config 3 | | [10] | [10] | |
| T1 | | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | s | 0.4 | 0.4 | |
| T3 | | s | [TBD] | [TBD] | |
| D1 | | s | [0.24] | [0.44] | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

**Table A.5.5.5.3.1-3: Cell specific test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode**

| Parameter | | Unit | Test 1 and Test 2 | | | | | Test 1 and Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CSI-RS of set $q_0$ | | | | | CSI-RS of set $q_1$ | | | | |
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PSS to SSS | | dB | 0 | | | | | 0 | | | | |
| EPRE ratio of PBCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | dB | | | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | dB | | | | | | | | | | |
| SNR_CSI-RS | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | | | [-98] | | | | |
| | Config 2 | | [-98] | | | | | [-98] | | | | |
| | Config 3 | | [-98] | | | | | [-98] | | | | |
| SS-RSRP(Note 3) | | dBm/SCS | | | | | | | | | | |
| $\hat{E}_s/I_{ot}$ | | | | | | | | | | | | |
| $\hat{E}_s/N_{oc}$ | | | | | | | | | | | | |
| Io | config 1, 2 | dBm/9.36 MHz | | | | | | | | | | |
| | Config 3, 4 | dBm/38.1 MHz | | | | | | | | | | |
| Propagation condition | | | [TDLA30-75] | | | | | [TDLA30-75] | | | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

**Table A.5.5.5.3.1-4: Measurement gap configuration for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

**Table A.5.5.5.3.1-5: NZP-CSI-RS resource configuration for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation[Note 1] | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.4.5.1.7.1-1 | | |

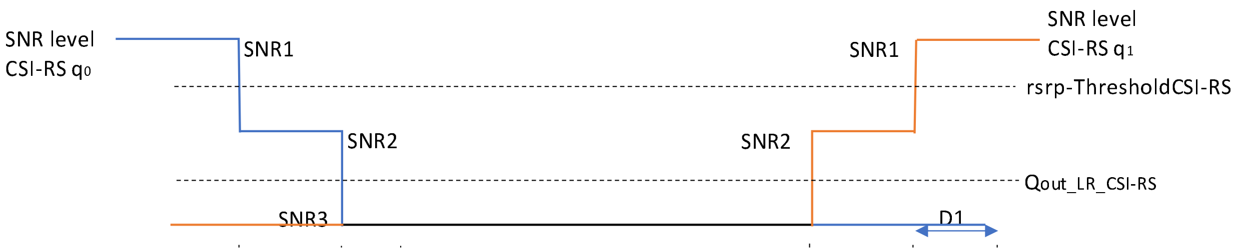


**Figure A.5.5.5.3.1-1: SNR variation SSB for CSI-RS based beam failure detection and link recovery testing in non-DRX mode**

### A.5.5.5.3.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_1$.

No later than time point F occurring no later than D1 = [TBD] ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set $q_1$.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

## A.5.5.5.4 EN-DC Beam Failure Detection and Link Recovery Test for FR2 PSCell configured with CSI-RS-based BFD and LR in DRX mode

### A.5.5.5.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set $q_0$ configured for a serving PSCell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set $q_1$. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.5.5.5.4.1-1, A.5.5.5.4.1-2, A.5.5.5.4.1-3, A.5.5.5.4.1-4, A.5.5.5.4.1-5 and A.5.5.5.4.1-6 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.4.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the CSI-RS in set $q_0$ in the active PSCell to emulate CSI-RS based beam failure. Figure A.5.5.5.4.1-1 additionally shows the variation of the downlink SNR of the

CSI-RS in set $q_1$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 2.

**Table A.5.5.5.4.1-1: Supported test configurations for FR2 PSCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100MHz bandwidth |

**Table A.5.5.5.4.1-2: General test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

| Parameter | | Unit | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active E-UTRA PCell | | | Cell 1 | Cell 1 | |
| E-UTRA RF Channel Number | | | 1 | 1 | |
| Active PCell | | | Cell 2 | Cell 2 | |
| RF Channel Number | | | 2 | 2 | |
| Duplex mode | Config 1 | | TDD | TDD | |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] | |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] | A.3.1.2 |
| SSB Configuration | Config 1 | | SSB.1 FR2 | SSB.1 FR2 | A.3.10 |
| SMTC Configuration | Config 1 | | SMTC.1 | SMTC.1 | A.3.11 |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz | |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] | |
| OCNG parameters | | | TBD | TBD | A.3.2.1 |
| CP length | | | Normal | Normal | |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] | |
| Beam failure detection trans mission parameters | DCI format | | 1-0 | 1-0 | |
| | Number of Control OFDM symbols | | 2 | 2 | |
| | Aggregation level | CCE | 8 | 8 | |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | DMRS precoder granularity | | REG bundle size | REG bundle size | |
| | REG bundle size | | 6 | 6 | |
| DRX | | | 640 | 640 | |
| Gap pattern ID | | | [N.A.] | *[*gp0*] | |

| | | | | | |
|---|---|---|---|---|---|
| csi-RS-Index | | | 2 | 2 | Number of SSB indexes used for beam failure detection |
| rlmInSyncOutOfSync Threshold | | | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | | TBD | TBD | Threshold used for $Q_{out\_LR\_SSB}$ |
| powerControlOffsetSS | | | NA | NA | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstance MaxCount | | | [n2] | [n2] | see TS 38.321 [7], section 5.17 |
| beamFailureDetection Timer | | | [pbfd4] | [pbfd4] | see TS 38.321 [7], section 5.17 |
| ZP CSI-RS configuation | | | TBD | TBD | |
| CSI-IM configuration | | | TBD | TBD | |
| Periodic CSI reporting | | | PUCCH | PUCCH | |
| CSI reporting periodicity | Config 1, 2 | slot | [5] | [5] | |
| | Config 3 | | [10] | [10] | |
| T1 | | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | s | 0.4 | 0.4 | |
| T3 | | s | [TBD] | [TBD] | |
| D1 | | s | [0.24] | [0.44] | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

**Table A.5.5.5.4.1-3: Cell specific test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

| Parameter | | Unit | Test 1 and Test 2 | | | | | Test 1 and Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CSI-RS of set $q_0$ | | | | | CSI-RS of set $q_1$ | | | | |
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PSS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PBCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | dB | | | 0 | | | | | 0 | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | dB | | | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | dB | | | | | | | | | | |
| SNR_CSI-RS | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | | | [-98] | | | | | [-98] | | |
| | Config 2 | | | | [-98] | | | | | [-98] | | |
| | Config 3 | | | | [-98] | | | | | [-98] | | |
| SS-RSRP(Note 3) | | dBm/SCS | | | | | | | | | | |
| $\hat{E}_s/I_{ot}$ | | | | | | | | | | | | |
| $\hat{E}_s/N_{oc}$ | | | | | | | | | | | | |
| Io | config 1, 2 | dBm/9.36 MHz | | | | | | | | | | |
| | Config 3, 4 | dBm/38.1 MHz | | | | | | | | | | |
| Propagation condition | | | | | [TDLA30-75] | | | | | [TDLA30-75] | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

**Table A.5.5.5.4.1-4: Measurement gap configuration for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

**Table A.5.5.5.4.1-5: NZP-CSI-RS resource configuration for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation[Note 1] | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.4.5.1.7.1-1 | | |

**Table A.5.5.5.4.1-6: DRX-Configuration for FR2 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode.**

| Field | Test 5 | Test 6 |
|---|---|---|
| | Value | Value |
| drx-onDurationTimer | [ms6] | [ms6] |
| drx-InactivityTimer | [ms1] | [ms1] |
| drx-RetransmissionTimerDL | [sl1] | [sl1] |
| drx-RetransmissionTimerUL | [sl1] | [sl1] |
| longDRX-CycleStartOffset | [ms640] | [ms40] |
| shortDRX | disable | disable |

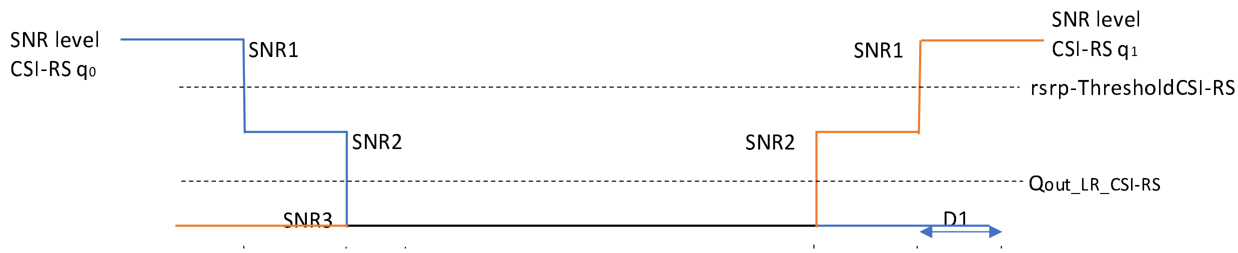


**Figure A.5.5.5.4.1-1: SNR variation SSB for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

### A.5.5.5.4.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_1$.

No later than time point F occurring no later than D1 = [TBD] ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set $q_1$.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

## A.5.5.6 Active BWP switch delay

### A.5.5.6.1 DCI-based and Timer-based Active BWP Switch

#### A.5.5.6.1.1 E-UTRAN – NR PSCell FR2 DL active BWP switch with non-DRX in synchronous EN-DC

##### A.5.5.6.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in section 8.6, and interruption requirement for E-UTRA victim cell defined in TS36.133 section 7.32.2.7. Supported test configurations are shown in Table A.5.5.6.1.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in Table A.5.5.6.1.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell is specified in Table A.5.5.6.1.1.1-3 below. The OTA related test parameters for FR2 is shown in Table A.5.5.6.1.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE is configured with 2 different UE-specific bandwidth parts for PSCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PSCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for PSCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE should switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH at PSCell's slot ($i+T_{BWPswitchDelay}$) as defined in section 8.6 and starts to report valid ACK/NACK for the PSCell no later than at slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from slot ($i+T_{BWPswitchDelay}$).

The starting time of PCell(Cell 1) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PSCell(Cell 2).

During T3,

The time period T3 starts from the slot #*j* immediately after the slot wherein *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH at PSCell's slot ($j+T_{BWPswitchDelay}$) as defined in section 8.6 and starts to report valid ACK/NACK for the PSCell at latest at slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from slot ($j+T_{BWPswitchDelay}$).

The starting time of PCell(Cell 1) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PSCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to E-UTRA PCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell during BWP switch of PSCell, respectively.

**Table A.5.5.6.1.1.1-1: DL BWP switch supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations<br>Note 2: A UE which fulfils the requirements in test case A.5.5.2.2 can skip the test cases in A.5.5.2.1. | |

**Table A.5.5.6.1.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| E-UTRA RF Channel Number | | 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel Number | | 2 | One NR radio channel is used for this test |
| Active PCell | | Cell 1 | PCell on RF channel number 1. |
| Active PSCell | | Cell 2 | PSCell on RF channel number 2. |
| CP length | | Normal | |
| DRX | | OFF | For both PCell and PSCell |
| *bwp-InactivityTimer* | ms | [200] | |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell2 timing offset to cell1 | µs | 3 | Synchronous EN-DC |
| T1 | s | [0.2] | |
| T2 | s | [0.2] | |
| T3 | s | [0.2] | |

**Table A.5.5.6.1.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | Unit | Cell 2 |
|---|---|---|
| Frequency Range | | FR2 |
| Duplex mode | | TDD |
| TDD configuration | | TDDConf.3.1 |
| $BW_{channel}$ | | 100 MHz: $N_{RB,c}$ = 66 |
| Active BWP ID | | 1, 2 |
| Initial BWP Configuration | | DLBWP.0.2 |
| Active BWP-1 Configuration | | DLBWP.1.1 |
| Active BWP-2 Configuration | | DLBWP.1.3 |
| PDSCH Reference measurement channel | | SR.3.1 TDD |
| RMSI CORESET parameters | | CR.3.1 TDD |
| Dedicated CORESET parameters | | CCR.3.1 TDD |
| OCNG Patterns | | OP.1 |
| SSB Configuration | | SSB.1 FR2 |
| SMTC Configuration | | SMTC.1 |
| Correlation Matrix and Antenna Configuration | | 1x2 Low |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | |
| EPRE ratio of PBCH to PBCH DMRS | | |
| EPRE ratio of PDCCH DMRS to SSS | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | |
| EPRE ratio of PDSCH DMRS to SSS | | |
| EPRE ratio of PDSCH to PDSCH | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | |
| Propagation Condition | | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in TS 38.213 [3] section 12. | | |

**Table A.5.5.6.1.1.1-4: OTA related test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | Unit | Cell 2 |
|---|---|---|
| Angle of arrival configuration | | According to section A.3.8.1 |
| $N_{oc}$ Note 1 | dBm/15 kHz | TBD |
| $N_{oc}$ Note 1 | dBm/SCS | TBD |
| SS-RSRP Note 2 | dBm/120 kHz Note3 | TBD |
| $\hat{E}_s/I_{ot}$ | dB | TBD |
| Io Note2 | dBm/95.04 MHz Note4 | TBD |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone. | | |

#### A.5.5.6.1.1.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell in a slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for PSCell in a slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in Table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1, the start time of PCell interruption during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start time of PCell interruption during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in TS36.133 Section 7.32.2.7.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in a slot (*i+Y1*), (*j+Y2*), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

Editor's note: whether E-UTRA PCell's interruption test requirement is needed or not depends on whether E-UTRA Pcell's interruption could be tested when PSCell is FR2 cell.

### A.5.5.6.1.2 E-UTRAN – NR PSCell FR2 DL active BWP switch with FR2 SCell in non-DRX in synchronous EN-DC

#### A.5.5.6.1.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in section 8.6, and interruption requirements for NR victim cell defined in section 8.2.1.2.7 and interruption requirement for E-UTRA victim cell defined in TS36.133 section 7.32.2.7. Supported test configurations are shown in Table A.5.5.6.1.2.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), one NR PSCell (Cell 2) and one NR SCell (Cell 3) as given in Table A.5.5.6.1.2.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and SCell are specified in Table A.5.5.6.1.2.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) and SCell (Cell 3) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), Cell 2 (PSCell) on radio channel 2 (PSCC) and Cell 3 (SCell) on radio channel 3 (SCC).
- UE is configured with 2 different UE-specific bandwidth parts for PSCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is configured with 1 UE-specific bandwidth parts the same as initial BWP for SCell, BWP-0 in Cell 3 before starting the test.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in SCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PSCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for PSCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH at PSCell's slot ($i+T_{BWPswitchDelay}$) as defined in section 8.6 and starts to report valid ACK/NACK for the PSCell no later than at slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from slot ($i+T_{BWPswitchDelay}$).

PCell(Cell 1) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.

SCell(Cell 3) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PSCell(Cell 2).

During T3,

The time period T3 starts from the slot #*j* immediately after the slot wherein *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH at PSCell's slot ($j+T_{BWPswitchDelay}$) as defined in section 8.6 and starts to report valid ACK/NACK for the PSCell at latest at slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from slot ($j+T_{BWPswitchDelay}$).

PCell(Cell 1) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

SCell(Cell 3) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PSCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to E-UTRA PCell and NR SCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell and SCell during BWP switch of PSCell, respectively.

**Table A.5.5.6.1.2.1-1: DL BWP switch supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations<br>Note 2: A UE which fulfils the requirements in test case A.5.5.6.1.2 can skip the test cases in A.5.5.6.1.1.<br>Note 3: NR configuration is the same for PSCell and SCells. | |

**Table A.5.5.6.1.2.1-2: General test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| E-UTRA RF Channel Number | | 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel Number | | 2, 3 | Two NR radio channel is used for this test |
| Active PCell | | Cell 1 | PCell on RF channel number 1. |
| Active PSCell | | Cell 2 | PSCell on RF channel number 2. |
| Active SCell | | Cell 3 | SCell on RF channel number 3. |
| CP length | | Normal | |
| DRX | | OFF | |
| *bwp-InactivityTimer* | ms | [200] | |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell-individual offset for cells on RF channel number 3 | dB | 0 | Individual offset for cells on SCC. |
| Cell2 timing offset to cell1 | μs | 3 | Synchronous EN-DC |
| Cell3 timing offset to cell2 | μs | 3 | Synchronous cells |
| T1 | s | [0.2] | |
| T2 | s | [0.2] | |
| T3 | s | [0.2] | |

**Table A.5.5.6.1.2.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | Unit | Cell 2 | Cell 3 |
|---|---|---|---|
| Frequency Range | | FR2 | |
| Duplex mode | | TDD | |
| TDD configuration | | TDDConf.3.1 | |
| $BW_{channel}$ | | 100 MHz: $N_{RB,c}$ = 66 | |
| Active BWP ID | | 1, 2 | 0 |
| Initial BWP Configuration | | DLBWP.0.2 | DLBWP.0.2 |
| Active BWP-0 Configuration | | NA | DLBWP.0.2 |
| Active BWP-1 Configuration | | DLBWP.1.3 | NA |
| Active BWP-2 Configuration | | DLBWP.1.1 | NA |
| PDSCH Reference measurement channel | | SR.3.1 TDD | |
| RMSI CORESET parameters | | CR.3.1 TDD | |
| Dedicated CORESET parameters | | CCR.3.1 TDD | |
| OCNG Patterns | | OP.1 | |
| SSB Configuration | | SSB.1 FR2 | |
| SMTC Configuration | | SMTC.1 | |
| TCI State | | TBD | |
| TRS Configuration | | TBD | |
| Antenna Configuration | | 1x2 | |
| Propagation Condition | | AWGN | |
| EPRE ratio of PSS to SSS | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | |
| EPRE ratio of PDSCH to PDSCH | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3. | | | |

**Table A.5.5.6.1.2.1-4: OTA related test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | Unit | Cell 2 | Cell 3 |
|---|---|---|---|
| Angle of arrival configuration | | According to section A.3.8.1 | According to section A.3.8.1 |
| $N_{oc}$ Note 1 | dBm/15 kHz | TBD | TBD |
| SS-RSRP Note 2 | dBm/120 kHz Note3 | TBD | TBD |
| $\hat{E}_S/I_{ot}$ | dB | TBD | TBD |
| Io Note2 | dBm/95.04 MHz Note4 | TBD | TBD |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone. | | | |

#### A.5.5.6.1.2.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell in a slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for PSCell in a slot ($j+T_{BWPswitchDelay}+k1$).

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1, the start of the interruption of PCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of PCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in TS36.133 Section 7.32.2.7.

During T1, the start of the interruption of SCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of SCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of SCell shall not be longer than the interruption duration specified for active BWP switch in Section 8.6.2.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in a slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

*Editor's note: FFS value of k1 for type 1 and type 2 UE.*

### A.5.5.6.2 RRC-based Active BWP Switch

#### A.5.5.6.2.1 E-UTRAN – NR PSCell FR2 DL active BWP switch with non-DRX in synchronous EN-DC

##### A.5.5.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in section 8.6. Supported test configurations are shown in Table A.5.5.6.2.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1) and one NR PSCell (Cell 2) as given in Table A.5.5.6.2.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell are specified in Table A.5.5.6.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC) and to Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 2 (PSCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with bandwidth part configuration BWP-2, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted $i$. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH at PSCell's slot ($i+X$) as defined in section 8.6 and starts to report valid ACK/NACK for the PSCell no later than at slot ($i+X+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from slot ($i+X$).

The test equipment verifies the DL BWP switch time in PSCell by counting the slots from the time when the RRC Reconfiguration message including BWP switch command is received till an ACK is received.

**Table A.5.5.6.2.1.1-1: DL BWP switch supported test configurations**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations | |

**Table A.5.5.6.2.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| E-UTRA RF Channel Number | | 1 | One E-UTRA radio channel is used for this test |
| NR RF Channel Number | | 2 | One NR radio channel is used for this test |
| Active PCell | | Cell 1 | PCell on RF channel number 1. |
| Active PSCell | | Cell 2 | PSCell on RF channel number 2. |
| CP length | | Normal | |
| DRX | | OFF | |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on PSCC. |
| Cell2 timing offset to cell1 | μs | 3 | Synchronous EN-DC |
| T1 | s | [0.2] | |

**Table A.5.5.6.2.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | Unit | Cell 2 |
|---|---|---|
| Frequency Range | | FR2 |
| Duplex mode | | TDD |
| TDD configuration | | TDDConf.3.1 |
| $BW_{channel}$ | | 100 MHz: $N_{RB,c}$ = 66 |
| Active BWP ID | | 1, 2 |
| Initial BWP Configuration | | DLBWP.0.2 |
| Active BWP-0 Configuration | | NA |
| Active BWP-1 Configuration | | DLBWP.1.3 |
| Active BWP-2 Configuration | | DLBWP.1.1 |
| PDSCH Reference measurement channel | | SR.3.1 TDD |
| RMSI CORESET parameters | | CR.3.1 TDD |
| Dedicated CORESET parameters | | CCR.3.1 TDD |
| OCNG Patterns | | OP.1 |
| SSB Configuration | | SSB.1 FR2 |
| SMTC Configuration | | SMTC.1 |
| TCI State | | TBD |
| TRS Configuration | | TBD |
| Antenna Configuration | | 1x2 |
| Propagation Condition | | AWGN |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | |
| EPRE ratio of PBCH to PBCH DMRS | | |
| EPRE ratio of PDCCH DMRS to SSS | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | |
| EPRE ratio of PDSCH DMRS to SSS | | |
| EPRE ratio of PDSCH to PDSCH | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in TS 38.213 [3] section 12. | | |

A.5.5.6.1.2.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell in a slot ($i+X+k1$).

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, if there are no uplink resources for reporting the ACK in a slot (*i+X+k1*), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

*Editor's note: FFS value of X, k1 for type 1 and type 2 UE.*

# A.5.6 Measurement procedure

## A.5.6.1 Intra-frequency Measurements

### A.5.6.1.1 EN-DC event triggered reporting test without gap under non-DRX

#### A.5.6.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.5.6.1.1.1-1.

**Table A.5.6.1.1.1-1: supported test configurations**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in Table A.5.6.1.1.1-2, A.5.6.1.1.1-3 and A.5.6.1.1.1-4 below.

In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

**Table A.5.6.1.1.1-2: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap without DRX**

| Parameter | Unit | Config | Value | Comment |
|---|---|---|---|---|
| Active cell | | 1~4 | E-UTRAN PCell (Cell 1) PSCell (Cell 2) | |
| Neighbour cell | | 1~4 | Cell 3 | Cell to be identified. |
| RF Channel Number | | 1~4 | 1: Cell 1<br>2: Cell 2 and Cell 3 | One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell. |
| Gap type | | 1~4 | n.a. | |
| Measurement gap repitition periodicity | ms | 1~4 | n.a. | |
| Measurement gap length | ms | 1~4 | n.a. | |
| Measurement gap offset | ms | 1~4 | n.a. | |
| SMTC configuration | | 1~4 | SMTC.3 FR2 | |
| A3-Offset | dB | 1~4 | -6 | |
| CP length | | 1~4 | Normal | |
| Hysteresis | dB | 1~4 | 0 | |
| Time To Trigger | s | 1~4 | 0 | |
| Filter coefficient | | 1~4 | 0 | L3 filtering is not used |
| DRX | | 1~4 | OFF | |
| Time offset between Cell 1 and Cell 2 | | 1~4 | 3 μs | Synchronous EN-DC |
| Time offset between Cell 2 and Cell 3 | | 1~4 | 3 μs | Synchronous cells |
| T1 | s | 1~4 | 5 | |
| T2 | s | 1~4 | 5 | |

**Table A.5.6.1.1.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap without DRX**

| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1~4 | TDDConf.3.1 | | TDDConf.3.1 | |
| Intial BWP configuration | | 1~4 | DLBWP.0 ULBWP.0 | | DLBWP.0 ULBWP.0 | |
| Active DL BWP configuration | | 1~4 | DLBWP.1 | | DLBWP.1 | |
| Active UL BWP configuration | | 1~4 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1~4 | SSB | | SSB | |
| PDSCH RMC configuration | | 1~4 | SR.3.1 TDD | | N/A | |
| RMSI CORESET RMC configuration | | 1~4 | CR.3.1 TDD | | CR.3.1 TDD | |
| Dedicated CORESET RMC configuration | | 1~4 | CCR.3.1 TDD | | CCR.3.1 TDD | |
| OCNG Patterns | | 1~4 | OP.1 | | OP.1 | |
| SSB configuration | | 1, 2 | SSB.1 FR2 | | SSB.1 FR2 | |
| | | 3, 4 | SSB.2 FR2 | | SSB.2 FR2 | |
| Propagation Condition | | 1~4 | AWGN | | | |

**Table A.5.6.1.1.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap without DRX**

| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| AoA setup | | 1~4 | A.3.8.x | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1~4 | TBD | TBD | TBD | TBD |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1~4 | TBD | | | |
| $N_{oc}$ Note 2 | dBm/SCS | 1, 2 | TBD | | | |
| | | 3, 4 | TBD | | | |
| SS-RSRP | dBm/SCS | 1, 2 | TBD | TBD | TBD | TBD |
| | | 3, 4 | TBD | TBD | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | 1~4 | TBD | TBD | TBD | TBD |
| $Io$ | dBm/95.04MHz | 1~4 | TBD | | TBD | |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | |

#### A.5.6.1.1.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 2.4s for a UE supporting power class 1,
- 1.44s for a UE supporting power class 2 or 3,
- [1.44s] for a UE supporting power class 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.5.6.1.2 EN-DC event triggered reporting test without gap under DRX

#### A.5.6.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.5.6.1.2.1-1.

**Table A.5.6.1.2.1-1: supported test configurations**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in Table A.5.6.1.2.1-2 ~ Table A.5.6.1.2.1-6 below.

In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

**Table A.5.6.1.2.1-2: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap with DRX**

| Parameter | Unit | Config | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active cell | | 1~4 | E-UTRAN PCell (Cell 1)<br>PSCell (Cell 2) | | |
| Neighbour cell | | 1~4 | Cell 3 | | Cell to be identified. |
| RF Channel Number | | 1~4 | 1: Cell 1<br>2: Cell 2 and Cell 3 | | One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell. |
| Gap type | | 1~4 | n.a. | | |
| Measurement gap repitition periodicity | ms | 1~4 | n.a. | | |
| Measurement gap length | ms | 1~4 | n.a. | | |
| Measurement gap offset | ms | 1~4 | n.a. | | |
| SMTC configuration | | 1~4 | SMTC.3 FR2 | | |
| A3-Offset | dB | 1~4 | -6 | | |
| CP length | | 1~4 | Normal | | |
| Hysteresis | dB | 1~4 | 0 | | |
| Time To Trigger | s | 1~4 | 0 | | |
| Filter coefficient | | 1~4 | 0 | | L3 filtering is not used |
| DRX | | 1~4 | ON | | DRX related parameters are defined in Table A.5.6.1.2.1-4 |
| Time offset between Cell 1 and Cell 2 | | 1~4 | 3 μs | | Synchronous EN-DC |
| Time offset between Cell 2 and Cell 3 | | 1~4 | 3 μs | | Synchronous cells |
| T1 | s | 1~4 | 5 | | |
| T2 | s | 1~4 | 10 | 52 | |

**Table A.5.6.1.2.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap with DRX**

| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1~4 | TDDConf.3.1 | | TDDConf.3.1 | |
| Intial BWP configuration | | 1~4 | DLBWP.0<br>ULBWP.0 | | DLBWP.0<br>ULBWP.0 | |
| Active DL BWP configuration | | 1~4 | DLBWP.1 | | DLBWP.1 | |
| Active UL BWP configuration | | 1~4 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1~4 | SSB | | SSB | |
| PDSCH RMC configuration | | 1~4 | SR.3.1 TDD | | N/A | |
| RMSI CORESET RMC configuration | | 1~4 | CR.3.1 TDD | | CR.3.1 TDD | |
| Dedicated CORESET RMC configuration | | 1~4 | CCR.3.1 TDD | | CCR.3.1 TDD | |
| OCNG Patterns | | 1~4 | OP.1 | | OP.1 | |
| SSB configuration | | 1, 2 | SSB.1 FR2 | | SSB.1 FR2 | |
| | | 3, 4 | SSB.2 FR2 | | SSB.2 FR2 | |
| Propagation Condition | | 1~4 | AWGN | | | |

**Table A.5.6.1.2.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap with DRX**

| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| AoA setup | | 1~4 | A.3.8.x | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1~4 | TBD | TBD | TBD | TBD |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1~4 | TBD | | | |
| $N_{oc}$ Note 2 | dBm/SCS | 1, 2 | TBD | | | |
| | | 3, 4 | TBD | | | |
| SS-RSRP | dBm/SCS | 1, 2 | TBD | TBD | TBD | TBD |
| | | 3, 4 | TBD | TBD | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | 3, 4 | TBD | TBD | TBD | TBD |
| $Io$ | dBm/95.04MHz | 1~4 | TBD | | TBD | |

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

**Table A.5.6.1.2.1-5: DRX-Configuration for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap with DRX**

| Field | Value | Value | Comment |
|---|---|---|---|
| | Test1 | Test2 | |
| onDurationTimer | psf1 | psf1 | As specified in clause 6.3.2 in TS 38.331 [2] |
| drx-InactivityTimer | psf1 | psf1 | |
| drx-RetransmissionTimer | psf1 | psf1 | |
| longDRX-CycleStartOffset | Sf40 | sf640 | |
| shortDRX | disable | disable | |

**Table A.5.6.1.2.1-6: *TimeAlignmentTimer* -Configuration for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap with DRX**

| Field | Value | Value | Comment |
|---|---|---|---|
| | Test1 | Test2 | |
| TimeAlignmentTimer | sf500 | sf500 | As specified in clause 6.3.2 in TS 38.331 [2] |

### A.5.6.1.2.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 7.2s for a UE supporting power class 1,
- 4.32s for a UE supporting power class 2 or 3,
- [4.32s] for a UE supporting power class 4

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 51.2s for a UE supporting power class 1,
- 30.72s for a UE supporting power class 2 or 3,
- [30.72s] for a UE supporting power class 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.5.6.1.3 EN-DC event triggered reporting test with per-UE gaps under non-DRX

#### A.5.6.1.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.5.6.1.3.1-1.

**Table A.5.6.1.3.1-1: supported test configurations**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in Table A.5.6.1.3.1-2 ~ 4 below.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

**Table A.5.6.1.3.1-2: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps without DRX**

| Parameter | Unit | Config | Value | Comment |
|---|---|---|---|---|
| Active cell | | 1~4 | E-UTRAN PCell (Cell 1) PSCell (Cell 2) | |
| Neighbour cell | | 1~4 | Cell 3 | Cell to be identified. |
| RF Channel Number | | 1~4 | 1: Cell 1<br>2: Cell 2 and Cell 3 | One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell. |
| Gap type | | 1~4 | Per-UE gaps | |
| Measurement gap repitition periodicity | ms | 1~4 | 40 | |
| Measurement gap length | ms | 1~4 | 6 | |
| Measurement gap offset | ms | 1~4 | 39 | |
| SMTC configuration | | 1~4 | SMTC.3 FR2 | |
| A3-Offset | dB | 1~4 | -6 | |
| CP length | | 1~4 | Normal | |
| Hysteresis | dB | 1~4 | 0 | |
| Time To Trigger | s | 1~4 | 0 | |
| Filter coefficient | | 1~4 | 0 | L3 filtering is not used |
| DRX | | 1~4 | OFF | |
| Time offset between Cell 1 and Cell 2 | | 1~4 | 3 μs | Synchronous EN-DC |
| Time offset between Cell 2 and Cell 3 | | 1~4 | 3 μs | Synchronous cells |
| T1 | s | 1~4 | 5 | |
| T2 | s | 1~4 | 5 | |

**Table A.5.6.1.3.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps without DRX**

| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1~4 | TDDConf.3.1 | | TDDConf.3.1 | |
| Intial BWP configuration | | 1~4 | DLBWP.0 ULBWP.0 | | DLBWP.0 ULBWP.0 | |
| Active DL BWP configuration | | 1~4 | DLBWP.1 | | DLBWP.1 | |
| Active UL BWP configuration | | 1~4 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1~4 | SSB | | SSB | |
| PDSCH RMC configuration | | 1~4 | SR.3.1 TDD | | N/A | |
| RMSI CORESET RMC configuration | | 1~4 | CR.3.1 TDD | | CR.3.1 TDD | |
| Dedicated CORESET RMC configuration | | 1~4 | CCR.3.1 TDD | | CCR.3.1 TDD | |
| OCNG Patterns | | 1~4 | OP.1 | | OP.1 | |
| SSB | | 1, 2 | SSB.1 FR2 | | SSB.1 FR2 | |
| | | 3, 4 | SSB.2 FR2 | | SSB.2 FR2 | |
| Propagation Condition | | 1~4 | AWGN | | | |

**Table A.5.6.1.3.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps without DRX**

| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| AoA setup | | 1~4 | A.3.8.x | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1~4 | TBD | TBD | TBD | TBD |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1~4 | TBD | | | |
| $N_{oc}$ Note 2 | dBm/SCS | 1, 2 | TBD | | | |
| | | 3, 4 | TBD | | | |
| SS-RSRP | dBm/SCS | 1, 2 | TBD | TBD | TBD | TBD |
| | | 3, 4 | TBD | TBD | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | 3, 4 | TBD | TBD | TBD | TBD |
| $Io$ | dBm/95.04MHz | 1~4 | TBD | | TBD | |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | |

#### A.5.6.1.3.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 3.2s for a UE supporting power class 1,
- 1.92s for a UE supporting power class 2 or 3,
- [1.92s] for a UE supporting power class 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2x$TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.5.6.1.4 EN-DC event triggered reporting test with per-UE gaps under DRX

#### A.5.6.1.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.5.6.1.4.1-1.

**Table A.5.6.1.4.1-1: supported test configurations**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in Table A.5.6.1.4.1-2 ~ 6.

During the test, Cell 2 and Cell 3 are transmitted from the direction determined according to A3.8.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

**Table A.5.6.1.4.1-2: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX**

| Parameter | Unit | Config | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active cell | | 1~4 | E-UTRAN PCell (Cell 1)<br>PSCell (Cell 2) | | |
| Neighbour cell | | 1~4 | Cell 3 | | Cell to be identified. |
| RF Channel Number | | 1~4 | 1: Cell 1<br>2: Cell 2 and Cell 3 | | One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell. |
| Gap type | | 1~4 | Per-UE gaps | | |
| Measurement gap repitition periodicity | ms | 1~4 | 40 | | |
| Measurement gap length | ms | 1~4 | 6 | | |
| Measurement gap offset | ms | 1~4 | 39 | | |
| SMTC configuration | | 1~4 | SMTC.3 FR2 | | |
| A3-Offset | dB | 1~4 | -6 | | |
| CP length | | 1~4 | Normal | | |
| Hysteresis | dB | 1~4 | 0 | | |
| Time To Trigger | s | 1~4 | 0 | | |
| Filter coefficient | | 1~4 | 0 | | L3 filtering is not used |
| DRX | | 1~4 | ON | | DRX related parameters are defined in Table A.5.6.1.4.1-5 |
| Time offset between Cell 1 and Cell 2 | | 1~4 | 3 μs | | Synchronous EN-DC |
| Time offset between Cell 2 and Cell 3 | | 1~4 | 3 μs | | Synchronous cells |
| T1 | s | 1~4 | 5 | | |
| T2 | s | 1~4 | 10 | 52 | |

**Table A.5.6.1.4.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX**

| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |

| | | | | |
|---|---|---|---|---|
| TDD configuration | | 1~4 | TDDConf.3.1 | TDDConf.3.1 |
| Intial BWP configuration | | 1~4 | DLBWP.0<br>ULBWP.0 | DLBWP.0<br>ULBWP.0 |
| Active DL BWP configuration | | 1~4 | DLBWP.1 | DLBWP.1 |
| Active UL BWP configuration | | 1~4 | ULBWP.1 | ULBWP.1 |
| RLM-RS | | 1~4 | CSI-RS | CSI-RS |
| PDSCH RMC configuration | | 1~4 | SR.3.1 TDD | N/A |
| RMSI CORESET RMC configuration | | 1~4 | CR.3.1 TDD | CR.3.1 TDD |
| Dedicated CORESET RMC configuration | | 1~4 | CCR.3.1 TDD | CCR.3.1 TDD |
| OCNG Patterns | | 1~4 | OP.1 | OP.1 |
| SSB | | 1, 2 | SSB.1 FR2 | SSB.1 FR2 |
| | | 3, 4 | SSB.2 FR2 | SSB.2 FR2 |
| Propagation Condition | | 1~4 | AWGN | |

**Table A.5.6.1.4.1-4: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX**

| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| AoA setup | | 1~4 | A.3.8.x | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1~4 | TBD | TBD | TBD | TBD |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1~4 | TBD | | | |
| $N_{oc}$ Note 2 | dBm/SCS | 1, 2 | TBD | | | |
| | | 3, 4 | TBD | | | |
| SS-RSRP | dBm/SCS | 1, 2 | TBD | TBD | TBD | TBD |
| | | 3, 4 | TBD | TBD | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | 3, 4 | TBD | TBD | TBD | TBD |
| $Io$ | dBm/95.04MHz | 1~4 | TBD | | TBD | |
| | Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | |

**Table A.5.6.1.4.1-5: DRX-Configuration for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX**

| Field | Value | Value | Comment |
|---|---|---|---|
| | Test1 | Test2 | |
| onDurationTimer | psf1 | psf1 | As specified in clause 6.3.2 in TS 38.331 [2] |
| drx-InactivityTimer | psf1 | psf1 | |
| drx-RetransmissionTimer | psf1 | psf1 | |
| longDRX-CycleStartOffset | Sf40 | sf640 | |
| shortDRX | disable | disable | |

**Table A.5.6.1.4.1-6: *TimeAlignmentTimer* -Configuration for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX**

| Field | Value | Value | Comment |
|---|---|---|---|
| | Test1 | Test2 | |
| TimeAlignmentTimer | sf500 | sf500 | As specified in clause 6.3.2 in TS 38.331 [2] |

#### A.5.6.1.4.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 7.2s for a UE supporting power class 1,
- 4.32s for a UE supporting power class 2 or 3,
- [4.32s] for a UE supporting power class 4

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 51.20s for a UE supporting power class 1,
- 30.72s for a UE supporting power class 2 or 3,
- [30.72s] for a UE supporting power class 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

## A.5.6.2 Inter-frequency Measurements

### A.5.6.2.1 EN-DC event triggered reporting tests for FR2 cell without SSB time index detection when DRX is not used

#### A.5.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR2 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.5.6.2.1.1-1, A.5.6.2.1.1-2, and A.5.6.2.1.1-3. The TCI status for cell2 is defined in table [TBD] and TRS configuration for cell2 is defined in table [TBD].

In test 1 measurement gap pattern configuration # 0 as defined in Table A.5.6.2.1.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table A.5.6.2.1.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.2-1. Supported test configurations are shown in table A.5.6.2.1.1-1.

**Table A.5.6.2.1.1-1 EN-DC event triggered reporting tests without SSB index reading for FR2-FR2**

| Config | Description |
|---|---|
| 1 | LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations<br>Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

**Table A.5.6.2.1.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection**

| Parameter | Unit | Test configuration | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| E-UTRA RF Channel Number | | Config 1,2 | 1 | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number | | Config 1,2 | 1, 2 | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1,2 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | LTE Cell 1 is on E-UTRA RF channel number 1.<br>NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2 | NR cell 3 | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2 | 0 | 13 | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2 | 39 | 39 | |
| SMTC-SSB parameters | | Config 1,2 | SSB.1 FR2 | | As specified in clause A.3.10.2 |
| A3-Offset | dB | Config 1,2 | -6 | | |
| Hysteresis | dB | Config 1,2 | 0 | | |
| CP length | | Config 1,2 | Normal | | |
| TimeToTrigger | s | Config 1,2 | 0 | | |
| Filter coefficient | | Config 1,2 | 0 | | L3 filtering is not used |
| DRX | | Config 1,2 | OFF | | DRX is not used |
| Time offset between PCell and PSCell | | Config 1,2 | 3 µs | | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | Config 1,2 | 3µs | | Synchronous cells. |
| T1 | s | Config 1,2 | 5 | | |
| T2 | s | Config 1,2 | TBD | TBD | |

**Table A.5.6.2.1.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | Config 1,2 | 1 | | 2 | |
| Duplex mode | | Config 1,2 | TDD | | TDD | |
| $BW_{channel}$ | MHz | Config 1,2 | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | MHz | Config 1,2 | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| TDD configuration | | Config 1,2 | TDDConf.3.1 | | TDDConf.3.1 | |
| Initial DL BWP | | Config 1,2 | DLBWP.0.1 | | NA | |
| Dedicated DL BWP | | Config 1,2 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP | | Config 1,2 | ULBWP.1.1 | | NA | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | Config 1,2 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | Config 1,2 | SR.3.1 TDD | | - | |
| CORESET Reference Channel | | Config 1,2 | CR.3.1 TDD | | - | |
| SMTC configuration defined in A.3.11.1 and A.3.11. 2 | | Config 1,2 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2 | 120 | | 120 | |
| EPRE ratio of PSS to SSS | | Config 1,2 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| UE orientation around TBD axis and TBD axis | degrees | Config 1,2 | NA | | TBD | |
| Relative difference in angle of arrival of cell 3 relative to cell 2 | degrees | Config 1,2 | NA | | NA | TBD |
| $N_{oc}$ Note2 | dBm/15 kHz Note5 | | TBD | | TBD | |
| $N_{oc}$ Note2 | dBm/SCS Note4 | Config 1,2 | TBD | | TBD | |
| SS-RSRP Note 3 | dBm/SCS Note5 | Config 1,2 | TBD | TBD | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2 | TBD | TBD | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2 | TBD | TBD | TBD | TBD |
| Io Note3 | dBm/95.04 MHz Note5 | Config 1,2 | TBD | TBD | TBD | TBD |
| Propagation Condition | | Config 1,2 | AWGN | | | |

| | |
|---|---|
| Note 1: | OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. |
| Note 2: | Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. |
| Note 3: | SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |
| Note 4: | SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. |
| Note 5: | Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone |
| Note 6: | As observed with 0dBi gain antenna at the centre of the quiet zone |

##### A.5.6.2.1.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2x$TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

#### A.5.6.2.2 EN-DC event triggered reporting tests for FR2 cell without SSB time index detection when DRX is used

##### A.5.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR2 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.5.6.2.2.1-1, A.5.6.2.2.1-2, and A.5.6.2.2.1-3. The TCI status for cell2 is defined in table [TBD] and TRS configuration for cell2 is defined in table [TBD].

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.5.6.2.2.1-2 is provided for UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table A.5.6.2.2.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.2-1. Supported test configurations are shown in table A.5.6.2.2.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

**Table A.5.6.2.2.1-1 EN-DC event triggered reporting tests without SSB index reading for FR2-FR2**

| Config | Description |
|---|---|
| 1 | LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations<br>Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

**Table A.5.6.2.2.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection**

| Parameter | Unit | Test configuration | Value | | | | Comment |
|---|---|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | Test 3 | Test 4 | |
| E-UTRA RF Channel Number | | Config 1,2 | 1 | | | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number | | Config 1,2 | 1, 2 | | | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1,2 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | | | LTE Cell 1 is on E-UTRA RF channel number 1.<br>NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2 | NR cell 3 | | | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2 | 0 | | 13 | | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2 | 39 | | 39 | | |
| SMTC-SSB parameters | | Config 1,2 | SSB.1 FR2 | | | | As specified in clause A.3.10.2 |
| A3-Offset | dB | Config 1,2 | -6 | | | | |
| Hysteresis | dB | Config 1,2 | 0 | | | | |
| CP length | | Config 1,2 | Normal | | | | |
| TimeToTrigger | s | Config 1,2 | 0 | | | | |
| Filter coefficient | | Config 1,2 | 0 | | | | L3 filtering is not used |
| DRX | | Config 1,2 | DRX.1 | DRX.2 | DRX.1 | DRX.2 | DRX is not used |
| Time offset between PCell and PSCell | | Config 1,2 | 3 µs | | | | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | Config 1,2 | 3µs | | | | Synchronous cells. |
| T1 | s | Config 1,2 | 5 | | | | |
| T2 | s | Config 1,2 | TBD | TBD | TBD | TBD | |

**Table A.5.6.2.2.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | Config 1,2 | 1 | | 2 | |
| Duplex mode | | Config 1,2 | TDD | | TDD | |
| $BW_{channel}$ | MHz | Config 1,2 | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | MHz | Config 1,2 | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| TDD configuration | | Config 1,2 | TDDConf.3.1 | | TDDConf.3.1 | |
| Initial DL BWP | | Config 1,2 | DLBWP.0.1 | | NA | |
| Dedicated DL BWP | | Config 1,2 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP | | Config 1,2 | ULBWP.1.1 | | NA | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | Config 1,2 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | Config 1,2 | SR.3.1 TDD | | - | |
| CORESET Reference Channel | | Config 1,2 | CR.3.1 TDD | | - | |
| SMTC configuration defined in A.3.11.1 and A.3.11. 2 | | Config 1,2 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2 | 120 | | 120 | |
| EPRE ratio of PSS to SSS | | Config 1,2 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| UE orientation around TBD axis and TBD axis | degrees | Config 1,2 | NA | | TBD | |
| Relative difference in angle of arrival of cell 3 relative to cell 2 | degrees | Config 1,2 | NA | | NA | TBD |
| $N_{oc}$ Note2 | dBm/15 kHz Note5 | | TBD | | TBD | |
| $N_{oc}$ Note2 | dBm/SCS Note4 | Config 1,2 | TBD | | TBD | |
| SS-RSRP Note 3 | dBm/SCS Note5 | Config 1,2 | TBD | TBD | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2 | TBD | TBD | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2 | TBD | TBD | TBD | TBD |
| Io Note3 | dBm/95.04 MHz Note5 | Config 1,2 | TBD | TBD | TBD | TBD |
| Propagation Condition | | Config 1,2 | AWGN | | | |

| | |
|---|---|
| Note 1: | OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. |
| Note 2: | Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. |
| Note 3: | SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |
| Note 4: | SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. |
| Note 5: | Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone |
| Note 6: | As observed with 0dBi gain antenna at the centre of the quiet zone |

##### A.5.6.2.2.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2 , 3 and 4 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2x$TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

#### A.5.6.2.3 EN-DC event triggered reporting tests for FR2 cell with SSB time index detection when DRX is not used

##### A.5.6.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR2 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.5.6.2.3.1-1, A.5.6.2.3.1-2, and A.5.6.2.3.1-3. The TCI status for cell2 is defined in table [TBD] and TRS configuration for cell2 is defined in table [TBD].

In test 1 measurement gap pattern configuration # 0 as defined in Table A.5.6.2.3.1-1 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table A.5.6.2.3.1-1 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.2-1. Supported test configurations are shown in table A.5.6.2.3.1-1.

**Table A.5.6.2.3.1-1 EN-DC event triggered reporting tests with SSB index reading for FR2-FR2**

| Config | Description |
|---|---|
| 1 | LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations<br>Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

**Table A.5.6.2.3.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection**

| Parameter | Unit | Test configuration | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| E-UTRA RF Channel Number | | Config 1,2 | 1 | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number | | Config 1,2 | 1, 2 | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1,2 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | LTE Cell 1 is on E-UTRA RF channel number 1.<br>NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2 | NR cell 3 | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2 | 0 | 13 | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2 | 39 | 39 | |
| SMTC-SSB parameters | | Config 1,2 | SSB.1 FR2 | | As specified in clause A.3.10.2 |
| A3-Offset | dB | Config 1,2 | -6 | | |
| Hysteresis | dB | Config 1,2 | 0 | | |
| CP length | | Config 1,2 | Normal | | |
| TimeToTrigger | s | Config 1,2 | 0 | | |
| Filter coefficient | | Config 1,2 | 0 | | L3 filtering is not used |
| DRX | | Config 1,2 | OFF | | DRX is not used |
| Time offset between PCell and PSCell | | Config 1,2 | 3 µs | | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | Config 1,2 | 3µs | | Synchronous cells. |
| T1 | s | Config 1,2 | 5 | | |
| T2 | s | Config 1,2 | TBD | TBD | |

**Table A.5.6.2.3.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | Config 1,2 | 1 | | 2 | |
| Duplex mode | | Config 1,2 | TDD | | TDD | |
| $BW_{channel}$ | MHz | Config 1,2 | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | MHz | Config 1,2 | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| TDD configuration | | Config 1,2 | TDDConf.3.1 | | TDDConf.3.1 | |
| Initial DL BWP | | Config 1,2 | DLBWP.0.1 | | NA | |
| Dedicated DL BWP | | Config 1,2 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP | | Config 1,2 | ULBWP.1.1 | | NA | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | Config 1,2 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | Config 1,2 | SR.3.1 TDD | | - | |
| CORESET Reference Channel | | Config 1,2 | CR.3.1 TDD | | - | |
| SMTC configuration defined in A.3.11.1 and A.3.11. 2 | | Config 1,2 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2 | 120 | | 120 | |
| EPRE ratio of PSS to SSS | | Config 1,2 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| UE orientation around TBD axis and TBD axis | degrees | Config 1,2 | NA | | TBD | |
| Relative difference in angle of arrival of cell 3 relative to cell 2 | degrees | Config 1,2 | NA | | NA | TBD |
| $N_{oc}$ Note2 | dBm/15 kHz Note5 | | TBD | | TBD | |
| $N_{oc}$ Note2 | dBm/SCS Note4 | Config 1,2 | TBD | | TBD | |
| SS-RSRP Note 3 | dBm/SCS Note5 | Config 1,2 | TBD | TBD | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2 | TBD | TBD | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2 | TBD | TBD | TBD | TBD |
| Io Note3 | dBm/95.04 MHz Note5 | Config 1,2 | TBD | TBD | TBD | TBD |
| Propagation Condition | | Config 1,2 | AWGN | | | |

| |
|---|
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 6: As observed with 0dBi gain antenna at the centre of the quiet zone |

#### A.5.6.2.3.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2x$TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.5.6.2.4 EN-DC event triggered reporting tests for FR2 cell with SSB time index detection when DRX is used

#### A.5.6.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR2 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.5.6.2.4.1-1, A.5.6.2.4.1-2, and A.5.6.2.4.1-3. The TCI status for cell2 is defined in table [TBD] and TRS configuration for cell2 is defined in table [TBD].In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.5.6.2.4.1-2 is provided for UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table A.5.6.2.4.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.2-1. Supported test configurations are shown in table A.5.6.2.4.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

**Table A.5.6.2.4.1-1: EN-DC event triggered reporting tests with SSB index reading for FR2-FR2**

| Config | Description |
|---|---|
| 1 | LTE FDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations<br>Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

**Table A.5.6.2.4.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection**

| Parameter | Unit | Test configuration | Value | | | | Comment |
|---|---|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | Test 3 | Test 4 | |
| E-UTRA RF Channel Number | | Config 1,2 | 1 | | | | One E-UTRAN TDD carrier frequencies is used. |
| NR RF Channel Number | | Config 1,2 | 1, 2 | | | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1,2 | LTE Cell 1 (PCell) and NR cell 2 (PScell) | | | | LTE Cell 1 is on E-UTRA RF channel number 1.<br>NR Cell 2 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2 | NR cell 3 | | | | NR cell 3 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2 | 0 | | 13 | | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2 | 39 | | 39 | | |
| SMTC-SSB parameters | | Config 1,2 | SSB.1 FR2 | | | | As specified in clause A.3.10.2 |
| A3-Offset | dB | Config 1,2 | -6 | | | | |
| Hysteresis | dB | Config 1,2 | 0 | | | | |
| CP length | | Config 1,2 | Normal | | | | |
| TimeToTrigger | s | Config 1,2 | 0 | | | | |
| Filter coefficient | | Config 1,2 | 0 | | | | L3 filtering is not used |
| DRX | | Config 1,2 | DRX.1 | DRX.2 | DRX.1 | DRX.2 | DRX is not used |
| Time offset between PCell and PSCell | | Config 1,2 | 3 µs | | | | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | Config 1,2 | 3µs | | | | Synchronous cells. |
| T1 | s | Config 1,2 | 5 | | | | |
| T2 | s | Config 1,2 | TBD | TBD | TBD | TBD | |

**Table A.5.6.2.4.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection**

| Parameter | Unit | Test configuration | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | Config 1,2 | 1 | | 2 | |
| Duplex mode | | Config 1,2 | TDD | | TDD | |
| $BW_{channel}$ | MHz | Config 1,2 | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | MHz | Config 1,2 | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| TDD configuration | | Config 1,2 | TDDConf.3.1 | | TDDConf.3.1 | |
| Initial DL BWP | | Config 1,2 | DLBWP.0.1 | | NA | |
| Dedicated DL BWP | | Config 1,2 | DLBWP.1.1 | | NA | |
| Dedicated UL BWP | | Config 1,2 | ULBWP.1.1 | | NA | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | Config 1,2 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | Config 1,2 | SR.3.1 TDD | | - | |
| CORESET Reference Channel | | Config 1,2 | CR.3.1 TDD | | - | |
| SMTC configuration defined in A.3.11.1 and A.3.11. 2 | | Config 1,2 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | kHz | Config 1,2 | 120 | | 120 | |
| EPRE ratio of PSS to SSS | | Config 1,2 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| UE orientation around TBD axis and TBD axis | degrees | Config 1,2 | NA | | TBD | |
| Relative difference in angle of arrival of cell 3 relative to cell 2 | degrees | Config 1,2 | NA | | NA | TBD |
| $N_{oc}$ Note2 | dBm/15 kHz Note5 | | TBD | | TBD | |
| $N_{oc}$ Note2 | dBm/SCS Note4 | Config 1,2 | TBD | | TBD | |
| SS-RSRP Note 3 | dBm/SCS Note5 | Config 1,2 | TBD | TBD | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2 | TBD | TBD | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2 | TBD | TBD | TBD | TBD |
| Io Note3 | dBm/95.04 MHz Note5 | Config 1,2 | TBD | TBD | TBD | TBD |
| Propagation Condition | | Config 1,2 | AWGN | | | |

| | |
|---|---|
| Note 1: | OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. |
| Note 2: | Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. |
| Note 3: | SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |
| Note 4: | SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. |
| Note 5: | Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone |
| Note 6: | As observed with 0dBi gain antenna at the centre of the quiet zone |

##### A.5.6.2.2.4 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2 , 3 and 4 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

# A.5.7 Measurement Performance requirements

## A.5.7.1 SS-RSRP

### A.5.7.1.1 intra-frequency case

#### A.5.7.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 10.1.2.1.1and 10.1.2.1.1 for intra-frequency measurements.

#### A.5.7.1.1.2 Test parameters

In this set of test cases all NR cells are on the same carrier frequency. Supported test configurations are shown in table A.5.7.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra frequency measurements are tested by using the parameters in Table A.5.7.1.1.2-2 and A.5.7.1.1.2-3. The E-UTRA PCell is configured as specified in section A.3.7.2.2. In all test cases, Cell 1 is the PCell, cell 2 is the PSCell and Cell 3 the target cell.

**Table A.5.7.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations**

| Configuration | Description |
|---|---|
| 1 | FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations | |

**Table A.5.7.1.1.2-2: SS-RSRP Intra frequency general test parameters**

| Parameter Note 5 | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|
| | | Cell 2 | Cell 3 | Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| SSB ARFCN | | freq1 | | freq1 | | freq1 | |
| Duplex mode | | TDD | | TDD | | TDD | |
| TDD configuration | | TDDConf.3.1 | | TDDConf.3.1 | | TDDConf.3.1 | |
| $BW_{channel}$ | MHz | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| PDSCH Reference measurement channel | | SR.3.1 TDD | - | SR.3.1 TDD | - | SR.3.1 TDD | - |
| RMSI CORESET Reference Channel | | CR.3.1 TDD | - | CR.3.1 TDD | - | CR.3.1 TDD | - |
| Dedicated CORESET Reference Channel | | CCR.3.1 TDD | - | CCR.3.1 TDD | - | CCR.3.1 TDD | - |
| OCNG Patterns | | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 |
| SSB configuration | | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 |
| SMTC configuration | | SMTC.1 | SMTC.1 | SMTC.1 | SMTC.1 | SMTC.1 | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | 120 | 120 | 120 | 120 | 120 |
| EPRE ratio of PSS to SSS<br>EPRE ratio of PBCH_DMRS to SSS<br>EPRE ratio of PBCH to PBCH_DMRS<br>EPRE ratio of PDCCH_DMRS to SSS<br>EPRE ratio of PDCCH to PDCCH_DMRS<br>EPRE ratio of PDSCH_DMRS to SSS<br>EPRE ratio of PDSCH to PDSCH_DMRS<br>EPRE ratio of OCNG DMRS to SSS Note 1<br>EPRE ratio of OCNG to OCNG DMRS Note 1 | dB | 0 | 0 | 0 | 0 | 0 | 0 |
| $\hat{E}_s/N_{oc}$ | dB | 6 | 1 | 6 | 1 | 3 | -1 |
| Propagation conditions | | AWGN | | | | | |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: All parameters apply for configuration 1 and 2

**Table A.5.7.1.1.2-3: SS-RSRP Intra frequency OTA related test parameters**

| Parameter Note 6 | | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|---|
| | | | Cell 2 | Cell 3 | Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| Angle of arrival configuration | | | According to section A.3.8.X | | According to section A.3.8.X | | According to section A.3.8.X | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/15kHz Note4 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/SCS Note 3 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| SS-RSRP Note2 | NR_TDD_FR2_A | dBm/SCS Note4 | TBD | TBD | TBD | TBD | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD | TBD |
| | NR_TDD_FR2_F | | | | | | TBD | TBD |
| | NR_TDD_FR2_G | | | | | | TBD | TBD |
| | NR_TDD_FR2_T | | | | | | TBD | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| Io Note2 | NR_TDD_FR2_A | dBm/95.04 MHz Note4 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 6: All parameters apply for configuration 1 and 2

##### A.5.7.1.1.3 Test Requirements

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in sections 10.1.3.1.1 and relative accuracy requirements in section 10.1.3.1.2.

### A.5.7.1.2 EN-DC inter-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

#### A.5.7.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 10.1.5.1.1 and 10.1.5.1.2 for intra frequency measurements with the testing configurations for NR cells in Table A.5.7.1.2.1-1.

**Table A.5.7.1.2.1-1: Applicable NR configurations for FR2 inter-frequency SS-RSRP accuracy test**

| Configuration | Description |
|---|---|
| 1 | FDD LTE PCell, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | TDD LTE PCell, 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 3 | FDD LTE PCell, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 4 | TDD LTE PCell, 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

#### A.5.7.1.2.2 Test parameters

In this set of test cases there are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on a different frequency than the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in Table A.5.7.1.2.2-1 and Table A.5.7.1.2.2-2 below. Both absolute and relative accuracy of RSRP intra frequency measurements are tested by using the parameters in Table A.5.7.1.2.2-1 and Table A.5.7.1.2.2-2. The inter frequency measurements are supported by a measurement gap. The TCI status for Cell 2 is defined in Table [TBD] and TRS configuration for Cell 2 is defined in Table [TBD].

**Table A.5.7.1.2.2-1: SS-RSRP inter-frequency test parameters**

| Parameter | Config | Unit | Test 1 | | Test 2 | |
|---|---|---|---|---|---|---|
| | | | Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| SSB ARFCN | 1~4 | | freq1 | freq2 | freq1 | freq2 |
| $BW_{channel}$ | 1~4 | | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| Duplex mode | 1~4 | | TDD | TDD | TDD | TDD |
| TDD configuration | 1~4 | | TDDConf.3.1 | | TDDConf.3.1 | |
| PDSCH Reference measurement channel | 1~4 | | SR.3.1 TDD | - | SR.3.1 TDD | - |
| RMSI CORESET Reference Channel | 1~4 | | CR.3.1 TDD | - | CR.3.1 TDD | - |
| Dedicated CORESET Reference Channel | 1~4 | | CCR.3.1 TDD | - | CCR.3.1 TDD | - |
| SSB configuration | 1,2 | | SSB.1 FR2 | | SSB.1 FR2 | |
| | 3,4 | | SSB.2 FR2 | | SSB.2 FR2 | |
| OCNG Patterns | 1~4 | | OP.1 | | OP.1 | |
| DL BWP | 1~4 | | DLBWP.1.1 | | DLBWP.1.1 | |
| UL BWP | 1~4 | | ULBWP.1.1 | | ULBWP.1.1 | |
| SMTC configuration | 1~4 | | SMTC.1 | | SMTC.1 | |
| EPRE ratio of PSS to SSS<br>EPRE ratio of PBCH DMRS to SSS<br>EPRE ratio of PBCH to PBCH DMRS<br>EPRE ratio of PDCCH DMRS to SSS<br>EPRE ratio of PDCCH to PDCCH DMRS<br>EPRE ratio of PDSCH DMRS to SSS<br>EPRE ratio of PDSCH to PDSCH DMRS<br>EPRE ratio of OCNG DMRS to SSS Note 1<br>EPRE ratio of OCNG to OCNG DMRS Note 1 | 1~4 | dB | 0 | 0 | 0 | 0 |
| Propagation condition | 1~4 | - | AWGN | | AWGN | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. | | | | | | |

**Table A.5.7.1.2.2-2: SS-RSRP inter-frequency OTA related test parameters**

| Parameter | | Config | Unit | Test 1 | | Test 2 | |
|---|---|---|---|---|---|---|---|
| | | | | Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| $N_{oc}$ | NR_TDD_FR2_A | 1~4 | dBm/15 kHz | TBD | | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD |
| | NR_TDD_FR2_F | | | | | | TBD |
| | NR_TDD_FR2_G | | | | | | TBD |
| | NR_TDD_FR2_T | | | | | | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD |
| $N_{oc}$ | NR_TDD_FR2_A | 1,2 | dBm/SSB SCS | TBD | | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD |
| | NR_TDD_FR2_F | | | | | | TBD |
| | NR_TDD_FR2_G | | | | | | TBD |
| | NR_TDD_FR2_T | | | | | | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD |
| | NR_TDD_FR2_A | 3,4 | | TBD | | TBD | TBD |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | NR_TDD_FR2_B | | | | | | TBD |
| | NR_TDD_FR2_F | | | | | | TBD |
| | NR_TDD_FR2_G | | | | | | TBD |
| | NR_TDD_FR2_T | | | | | | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD |
| $\hat{E}_s/I_{ot}$ | | 1~4 | dB | TBD | TBD | TBD | TBD |
| SS-RSRP[Note1] | NR_TDD_FR2_A | 1,2 | dBm/SCS | TBD | | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD |
| | NR_TDD_FR2_F | | | | | | TBD |
| | NR_TDD_FR2_G | | | | | | TBD |
| | NR_TDD_FR2_T | | | | | | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD |
| | NR_TDD_FR2_A | 3,4 | | TBD | | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD |
| | NR_TDD_FR2_F | | | | | | TBD |
| | NR_TDD_FR2_G | | | | | | TBD |
| | NR_TDD_FR2_T | | | | | | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD |
| Io[Note1] | NR_TDD_FR2_A | 1~4 | dBm/95.04MHz | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | TBD | |
| $\hat{E}_s/N_{oc}$ | | 1~4 | dB | TBD | TBD | TBD | TBD |
| Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | | | |

#### A.5.7.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 and Cell 3 shall fulfil the requirements in sections 10.1.5.1.1 and 10.1.5.1.2.

## A.5.7.2 SS-RSRQ

### A.5.7.2.1 Intra-frequency case

#### A.5.7.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.8.1.1.

#### A.5.7.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in Table A.5.7.2.1.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is test by using the parameters in Table A.5.7.2.1.2-2 and Table A.5.7.2.1.2-3. The configuration of cell 1 (E-UTRA PCell) is specified in section A.3.7.2.1. In all test cases, Cell 2 is the PSCell and Cell 3 is the target cell.

**Table A.5.7.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations**

| Configuration | Description |
|---|---|
| 1 | FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations | |

**Table A.5.7.2.1.2-2: SS-RSRQ Intra frequency test parameters**

| Parameter | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|
| | | Cell 2 | Cell 3 | Cell 2 | Cell 3 | Cell 2 | Cell 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SSB ARFCN | | **Freq2** | | **Freq2** | | **Freq2** | |
| Duplex mode | | TDD | | TDD | | TDD | |
| TDD configuration | | TDDConf.3.1 | | TDDConf.3.1 | | TDDConf.3.1 | |
| $BW_{channel}$ | MHz | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| PDSCH Reference measurement channel | | SR.3.1 TDD | | SR.3.1 TDD | | SR.3.1 TDD | |
| RMSI CORESET Reference Channel | | CR.3.1 TDD | - | CR.3.1 TDD | - | CR.3.1 TDD | - |
| Dedicated RMSI CORESET Reference Channel | | CCR.3 .1 TDD | - | CCR.3. 1 TDD | - | CCR.3. 1 TDD | - |
| OCNG Patterns | | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 |
| SMTC configuration | | SMTC.1 | | | | | |
| SSB configuration | | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | 120 | 120 | 120 | 120 | 120 |
| SS-RSSI-Measurement | | Not Applicable | | | | | |
| EPRE ratio of PSS to SSS | dB | 0 | 0 | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH_DMRS to SSS | | | | | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | | | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | | | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | | | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | | | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS Note 1 | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 | | | | | | | |
| $\hat{E}_s/N_{oc}$ | dB | 3 | 3 | -2.9 | -2.9 | -4 | -4 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | | | |

**Table A.5.7.2.1.2-3: SS-RSRQ Intra frequency OTA related test parameters**

| Parameter | | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|---|
| | | | Cell 1 | Cell 2 | Cell 1 | Cell 2 | Cell 1 | Cell 2 |
| Angle of arrival configuration | | | According to section A.3.8.X | | According to section A.3.8.X | | According to section A.3.8.X | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/15kHz Note4 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/SCS Note 3 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| SS-RSRP Note2 | NR_TDD_FR2_A | dBm/SCS Note4 | TBD | TBD | TBD | TBD | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD | TBD |
| | NR_TDD_FR2_F | | | | | | TBD | TBD |
| | NR_TDD_FR2_G | | | | | | TBD | TBD |
| | NR_TDD_FR2_T | | | | | | TBD | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD | TBD |
| SS-RSRQ Note2 | NR_TDD_FR2_A | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD | TBD |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | NR_TDD_FR2_C | | | | | | TBD | TBD |
| | NR_TDD_FR2_D | | | | | | TBD | TBD |
| | NR_TDD_FR2_E | | | | | | TBD | TBD |
| | NR_TDD_FR2_F | | | | | | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| Io Note2 | NR_TDD_FR2_A | dBm/95.04 MHz Note4 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 2: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 6: NR operating band groups are as defined in Section 3.5.2.

#### A.5.7.2.1.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in section 10.1.8.1.1.

### A.5.7.2.2 EN-DC Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

#### A.5.7.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.9.1.1 and 10.1.9.1.2 for inter-frequency measurement.

#### A.5.7.2.2.2 Test Parameters

In this test case the two NR cells (i.e., Cell 2 alnd Cell 3) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in Table A.5.7.2.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test setup in Table A.5.7.2.2.2-2 and Table A.5.7.2.2.2-3. In all test cases, Cell 2 is the PSCell and Cell 3 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in Table A.3.7.2.1-1.

**Table A.5.7.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

**Table A. 5.7.2.2.2-2: SS-RSRQ Inter frequency general test parameters**

| Parameter | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|
| | | Cell 2 | Cell 3 | Cell 2 | Cell 3 | Cell 2 | Cell 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SSB ARFCN | | Freq1 | freq2 | freq1 | Freq2 | freq1 | Freq2 |
| Duplex mode | | TDD | | TDD | | TDD | |
| TDD configuration | | TDDConf.3.1 | | TDDConf.3.1 | | TDDConf.3.1 | |
| $BW_{channel}$ | MHz | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| PDSCH Reference measurement channel | | SR.3.1 TDD | - | SR.3.1 TDD | - | SR.3.1 TDD | - |
| RMSI CORESET Reference Channel | | CR.3.1 TDD | - | CR.3.1 TDD | - | CR.3.1 TDD | - |
| OCNG Patterns | | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 |
| SMTC configuration | | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | 120 | 120 | 120 | 120 | 120 |
| EPRE ratio of PSS to SSS<br>EPRE ratio of PBCH_DMRS to SSS<br>EPRE ratio of PBCH to PBCH_DMRS<br>EPRE ratio of PDCCH_DMRS to SSS<br>EPRE ratio of PDCCH to PDCCH_DMRS<br>EPRE ratio of PDSCH_DMRS to SSS<br>EPRE ratio of PDSCH to PDSCH_DMRS<br>EPRE ratio of OCNG DMRS to SSS[Note 1] | dB | 0 | 0 | 0 | 0 | 0 | 0 |
| $\hat{E}_s / N_{oc}$ | dB | TBD | TBD | TBD | TBD | TBD | TBD |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRQ, SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

**Table A. 5.7.2.2.2-3: SS-RSRQ Inter frequency OTA related test parameters**

| Parameter | | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|---|
| | | | Cell 2 | Cell 3 | Cell 2 | Cell 3 | Cell 2 | Cell 3 |
| UE orientation around TBD axis and TBD axis | | degrees | TBD | | TBD | | TBD | |
| Relative difference in angle of arrival of cell 2 relative to cell 1 | | degrees | NA | TBD | NA | 0 | NA | 0 |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/15kHz Note4 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/SCS Note 3 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| SS-RSRP Note2 | NR_TDD_FR2_A | dBm/SCS Note4 | TBD | TBD | TBD | TBD | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD | TBD |
| | NR_TDD_FR2_F | | | | | | TBD | TBD |
| | NR_TDD_FR2_G | | | | | | TBD | TBD |
| | NR_TDD_FR2_T | | | | | | TBD | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD | TBD |
| SS-RSRQ Note2 | NR_TDD_FR2_A | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD | TBD |
| | NR_TDD_FR2_F | | | | | | TBD | TBD |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | NR_TDD_FR2_G | | | | | | TBD | TBD |
| | NR_TDD_FR2_T | | | | | | TBD | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| Io Note2 | NR_TDD_FR2_A | dBm/95.04 MHz Note4 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 2: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 3: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone<br>Note 6: NR operating band groups are as defined in Section 3.5.2. | | | | | | | | |

#### A.5.7.2.2.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in section 10.1.9.1.1 and 10.1.9.1.2.

## A.5.7.3 SS-SINR

## A.5.7.4 L1-RSRP measurement for beam reporting

### A.5.7.4.1 SSB based L1-RSRP measurement

#### A.5.7.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 9.5.2 and section 10.1.20.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in Table A.5.7.4.1.1-1.

The AoA setup for this test is TBD.

**Table A.5.7.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 3 | LTE FDD, NR 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 4 | LTE TDD, NR 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

#### A.5.7.4.1.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.5.7.4.1.2-1 and Table A.5.7.4.1.2-2 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in Table A.5.7.4.1.2-1 and Table A.5.7.4.1.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0 and 1. The TCI status for Cell 2 is defined in Table [TBD] and TRS configuration for Cell 2 is defined in Table [TBD].

**Table A.5.7.4.1.2-1: FR2 SSB based L1-RSRP general test parameters**

| Parameter | Config | Unit | Test 1 | Test 2 |
|---|---|---|---|---|
| SSB GSCN | 1~4 | | freq1 | freq1 |
| Duplex mode | 1~4 | | TDD | TDD |
| TDD Configuration | 1~4 | | TDDConf.3.1 | TDDConf.3.1 |
| $BW_{channel}$ | 1~4 | MHz | 100: $N_{RB,c}$ = 66 | 100: $N_{RB,c}$ = 66 |
| PDSCH Reference measurement channel | 1~4 | | SR.3.1 TDD | SR.3.1 TDD |
| RMSI CORESET Reference Channel | 1~4 | | CR.3.1 TDD | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | 1~4 | | CCR.3.1 TDD | CCR.3.1 TDD |
| SSB configuration | 1,2 | | SSB.1 FR2 | SSB.1 FR2 |
| | 3,4 | | SSB.2 FR2 | SSB.2 FR2 |
| OCNG Patterns | 1~4 | | OP.1 | OP.1 |
| DL BWP | 1~4 | | DLBWP.1.1 | DLBWP.1.1 |
| UL BWP | 1~4 | | ULBWP.1.1 | ULBWP.1.1 |
| SMTC configuration | 1~4 | | SMTC.1 | SMTC.1 |
| Number of reported RS | 1~4 | | 2 | 2 |
| L1-RSRP reporting period | 1~4 | | TBD | TBD |
| Propagation condition | 1~4 | | AWGN | AWGN |
| EPRE ratio of PSS to SSS | 1~4 | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | | | |
| EPRE ratio of OCNG DMRS to SSS Note 1 | | | | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 | | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. | | | | |

**Table A.5.7.4.1.2-2: FR2 SSB based L1-RSRP OTA related test parameters**

| Parameter | | Config | Unit | Test 1 | Test 2 |
|---|---|---|---|---|---|
| $N_{oc}$ Note1 | NR_TDD_FR2_A | 1~4 | dBm/15kHz | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | 1,2 | dBm/SSB SCS | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| | NR_TDD_FR2_A | 3,4 | | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| $\hat{E}_s/I_{ot}$ | | 1~4 | dB | TBD | TBD |
| | NR_TDD_FR2_A | 1,2 | dBm/SSB SCS | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |

| | | | | | |
|---|---|---|---|---|---|
| SSB RSRP Note1 | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| | NR_TDD_FR2_A | 3,4 | | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| Io Note1 | NR_TDD_FR2_A | 1,2 | dBm/95.04MHz | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| | NR_TDD_FR2_A | 3,4 | | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| $\hat{E}_s/N_{oc}$ | | 1~4 | dB | TBD | TBD |
| Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | |

#### A.5.7.4.1.3 Test Requirements

The L1-RSRP measurement accuracy for SSB#0 and SSB#1 of Cell 2 shall fulfil the requirements in sections 10.1.20.1.

Editor's Note: which reports are used to verify the accuracy is FFS

### A.5.7.4.2 CSI-RS based L1-RSRP measurement

#### A.5.7.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 9.5.3 and section 10.1.20.2 for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in Table A.5.7.4.2.1-1.

The AoA setup for this test is TBD.

**Table A.5.7.4.2.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz CSI-RS SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE TDD, NR 120 kHz CSI-RS SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

#### A.5.7.4.2.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.5.7.4.2.2-1 and Table A.5.7.4.2.2-2 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in Table A.5.7.4.2.2-1 and Table A.5.7.4.2.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform L1-RSRP measurement based on the CSI-RS resources 0 and 1. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as

SSB. Repetition is configured as TBD for the CSI-RS resource set. The TCI status for Cell 2 is defined in Table [TBD] and TRS configuration for Cell 2 is defined in Table [TBD].

**Table A.5.7.4.2.2-1: FR2 CSI-RS based L1-RSRP general test parameters**

| Parameter | Config | Unit | Test 1 | Test 2 |
|---|---|---|---|---|
| SSB GSCN | 1~2 | | freq1 | freq1 |
| Duplex mode | 1~2 | | TDD | TDD |
| TDD Configuration | 1~2 | | TDDConf.3.1 | TDDConf.3.1 |
| $BW_{channel}$ | 1~2 | MHz | 100: $N_{RB,c}$ = 66 | 100: $N_{RB,c}$ = 66 |
| PDSCH Reference measurement channel | 1~2 | | SR.3.1 TDD | SR.3.1 TDD |
| RMSI CORESET Reference Channel | 1~2 | | CR.3.1 TDD | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | 1~2 | | CCR.3.1 TDD | CCR.3.1 TDD |
| SSB configuration | 1~2 | | SSB.1 FR2 | SSB.1 FR2 |
| OCNG Patterns | 1~2 | | OP.1 | OP.1 |
| DL BWP | 1~2 | | DLBWP.1.1 | DLBWP.1.1 |
| UL BWP | 1~2 | | ULBWP.1.1 | ULBWP.1.1 |
| SMTC configuration | 1~2 | | SMTC.1 | SMTC.1 |
| CSI-RS 0 | 1~2 | | CSI-RS.3.2 TDD | CSI-RS.3.2 TDD |
| CSI-RS 1 | 1~2 | | CSI-RS.3.3 TDD | CSI-RS.3.3 TDD |
| Number of reported RS | 1~2 | | 2 | 2 |
| Propagation condition | 1~2 | | AWGN | AWGN |
| EPRE ratio of PSS to SSS | 1~2 | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | | | |
| EPRE ratio of OCNG DMRS to SSS Note 1 | | | | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 | | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. | | | | |

**Table A.5.7.4.2.2-2: FR2 CSI-RS based L1-RSRP OTA related test parameters**

| Parameter | | Config | Unit | Test 1 | Test 2 |
|---|---|---|---|---|---|
| $N_{oc}$ Note2 | NR_TDD_FR2_A | 1~2 | dBm/15kHz | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| $N_{oc}$ Note2 | NR_TDD_FR2_A | 1~2 | dBm/CSI-RS SCS | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| $\hat{E}_s/I_{ot}$ | | 1~2 | dB | TBD | TBD |
| CSI-RS RSRP Note3 | NR_TDD_FR2_A | 1~2 | dBm/CSI-RS SCS | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |

| | | | | | |
|---|---|---|---|---|---|
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| Io [Note3] | NR_TDD_FR2_A | 1~2 | dBm/95.04MHz | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| $\hat{E}_s/N_{oc}$ | | 1~2 | dB | TBD | TBD |
| Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | |

#### A.5.7.4.2.3 Test Requirements

The L1-RSRP measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 2 shall fulfil the requirements in sections 10.1.20.2.

Editor's Note: which reports are used to verify the accuracy is FFS

# A.6 NR standalone tests in FR1

## A.6.1 SA: RRC_IDLE state mobility

### A.6.1.1 Cell re-selection to NR

#### A.6.1.1.1 Intra-frequency NR case

##### A.6.1.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements specified in clause 4.2.2.3.

##### A.6.1.1.1.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.6.1.1.1.2-1, A.6.1.1.1.2-2 and A.6.1.1.1.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only cell 1 is already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing cell 2.

**Table A.6.1.1.1.2-1: Supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

**Table A.6.1.1.1.2-2: General test parameters for intra frequency NR cell re-selection test case**

| Parameter | | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|---|
| Initial condition | Active cell | | 1, 2, 3 | Cell1 | |
| | Neighbour cells | | 1, 2, 3 | Cell2 | |
| T2 end condition | Active cell | | 1, 2, 3 | Cell2 | |
| | Neighbour cells | | 1, 2, 3 | Cell1 | |
| Final condition | Active cell | | 1, 2, 3 | Cell1 | |
| RF Channel Number | | | 1, 2, 3 | 1 | |
| Time offset between cells | | | 1 | 3 ms | Asynchronous cells |
| | | | 2 | 3 μs | Synchronous cells |
| | | | 3 | 3 μs | Synchronous cells |
| Access Barring Information | | - | 1, 2, 3 | Not Sent | No additional delays in random access procedure. |
| SSB configuration | | | 1 | SSB.1 FR1 | |
| | | | 2 | SSB.1 FR1 | |
| | | | 3 | SSB.2 FR1 | |
| SMTC configuration | | | 1 | SMTC pattern 2 | |
| | | | 2 | SMTC pattern 1 | |
| | | | 3 | SMTC pattern 1 | |
| DRX cycle length | | s | 1, 2, 3 | 1.28 | The value shall be used for all cells in the test. |
| PRACH configuration index | | | 1, 2, 3 | 87 | The detailed configuration is specified in TS 38.211 clause 6.3.3.2 |
| rangeToBestCell | | | 1, 2, 3 | Not configured | |
| T1 | | s | 1, 2, 3 | >7 | During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2 |
| T2 | | s | 1, 2, 3 | TBD | T2 needs to be defined so that cell re-selection reaction time is taken into account. |
| T3 | | s | 1, 2, 3 | TBD | T3 needs to be defined so that cell re-selection reaction time is taken into account. |

**Table A.6.1.1.1.2-3: Cell specific test parameters for intra frequency NR cell re-selection test case in AWGN**

| Parameter | Unit | Test configuration | Cell 1 T1 | Cell 1 T2 | Cell 1 T3 | Cell 2 T1 | Cell 2 T2 | Cell 2 T3 |
|---|---|---|---|---|---|---|---|---|
| TDD configuration | | 1 | N/A | | | N/A | | |
| | | 2 | TDDConf.1.1 | | | TDDConf.1.1 | | |
| | | 3 | TDDConf.2.1 | | | TDDConf.2.1 | | |
| PDSCH RMC configuration | | 1 | SR.1.1 FDD | | | N/A | | |
| | | 2 | SR.1.1 TDD | | | | | |
| | | 3 | SR.2.1 TDD | | | | | |
| RMSI CORESET RMC configuration | | 1 | CR.1.1 FDD | | | CR.1.1 FDD | | |
| | | 2 | CR.1.1 TDD | | | CR.1.1 TDD | | |
| | | 3 | CR.2.1 TDD | | | CR.2.1 TDD | | |
| Dedicated CORESET RMC configuration | | 1 | CCR.1.1 FDD | | | CCR.1.1 FDD | | |
| | | 2 | CCR.1.1 TDD | | | CCR.1.1 TDD | | |
| | | 3 | CCR.2.1 TDD | | | CCR.2.1 TDD | | |
| OCNG Pattern | | 1, 2, 3 | OP.1 defined in A.3.2.1 | | | OP.1 defined in A.3.2.1 | | |
| Initial DL BWP configuration | | 1, 2, 3 | DLBWP.0 | | | DLBWP.0 | | |
| Initial UL BWP configuration | | 1, 2, 3 | ULBWP.0 | | | ULBWP.0 | | |
| RLM-RS | | 1, 2, 3 | SSB | | | SSB | | |
| Qrxlevmin | dBm/SCS | 1, 2 | -140 | | | -140 | | |
| | | 3 | -137 | | | -137 | | |
| Pcompensation | dB | 1, 2, 3 | 0 | | | 0 | | |
| $Qhyst_s$ | dB | 1, 2, 3 | 0 | | | 0 | | |
| $Qoffset_{s,n}$ | dB | 1, 2, 3 | 0 | | | 0 | | |
| Cell_selection_and_reselection_quality_measurement | | 1, 2, 3 | SS-RSRP | | | SS-RSRP | | |
| $\hat{E}_s/I_{ot}$ | dB | 1, 2, 3 | 16 | -3.11 | 2.79 | -infinity | 2.79 | -3.11 |
| $N_{oc}$ Note2 | dBm/SCS | 1 | -98 | | | | | |
| | | 2 | -98 | | | | | |
| | | 3 | -95 | | | | | |
| $N_{oc}$ Note2 | dBm/15 kHz | 1, 2, 3 | -98 | | | | | |
| $\hat{E}_s/N_{oc}$ | dB | 1, 2, 3 | 16 | 13 | 16 | -infinity | 16 | 13 |
| SS-RSRP Note3 | dBm/SCS | 1 | -82 | -85 | -82 | -infinity | -82 | -85 |
| | | 2 | -82 | -85 | -82 | -infinity | -82 | -85 |
| | | 3 | -79 | -82 | -79 | -infinity | -79 | -82 |
| Io | dBm/9.36 MHz | 1 | -53.94 | -52.21 | -52.21 | -infinity | -52.21 | -52.21 |
| | dBm/9.36 MHz | 2 | -53.94 | -52.21 | -52.21 | -infinity | -52.21 | -52.21 |
| | dBm/38.16 MHz | 3 | -47.85 | -46.12 | -46.12 | -infinity | -46.12 | -46.12 |
| Treselection | s | 1, 2, 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sintrasearch | dB | 1, 2, 3 | Not sent | | | Not sent | | |
| Propagation Condition | | 1, 2, 3 | AWGN | | | | | |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

##### A.6.1.1.1.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the RRC CONNECTION REQUEST message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than TBD s.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on cell 1, and starts to send preambles on the PRACH for sending the RRC CONNECTION REQUEST message to perform a Tracking Area Update procedure on cell 1.

The cell re-selection delay shall be less than TBD s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR\_Intra} + T_{SI-NR}$, and to an already detected cell can be expressed as: $T_{evaluate, NR\_ intra} + T_{SI-NR}$,

Where:

$T_{detect, NR\_Intra}$ See Table 4.2.2.3-1 in clause 4.2.2.3

$T_{evaluate, NR\_ intra}$ See Table 4.2.2.3-1 in clause 4.2.2.3

$T_{SI-NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; TBD is assumed in this test case.

This gives a total of TBD s, allow TBD s for the cell re-selection delay to a newly detectable cell and TBD s for the cell re-selection delay to an already detected cell in the test case, which we allow TBD s.

#### A.6.1.1.2 Cell reselection to FR1 inter-frequency NR case

##### A.6.1.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements specified in clause 4.2.2.4.

##### A.6.1.1.2.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.6.1.1.2.2-1, A.6.1.1.2.2-2 and A.6.1.1.2.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas and cell 2 is of higher priority than cell 1. Furthermore, UE has not registered with network for the tracking area containing cell 2.

**Table A.6.1.1.2.2-1: Supported test configurations**

| Configuration | Description of serving cell | Description of target cell |
|---|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | | |

**Table A.6.1.1.2.2-2: General test parameters for FR1 inter frequency NR cell re-selection test case**

| Parameter | | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|---|
| Initial condition | Active cell | | 1, 2, 3 | Cell2 | The UE camps on cell 2 in the initial phase and during T1 period the UE reselects to cell 1 |
| T1 end condition | Active cell | | 1, 2, 3 | Cell1 | The UE shall perform reselection to cell 1 during T1 |
| | Neighbour cells | | 1, 2, 3 | Cell2 | |
| T3 end condition | Active cell | | 1, 2, 3 | Cell2 | The UE shall perform reselection to cell 2 with higher priority during T3 |
| RF Channel Number | | | 1, 2, 3 | 1, 2 | |
| Time offset between cells | | | 1 | 3 ms | Asynchronous cells |
| | | | 2 | 3 μs | Synchronous cells |
| | | | 3 | 3 μs | Synchronous cells |
| Access Barring Information | | - | 1, 2, 3 | Not Sent | No additional delays in random access procedure. |
| SSB configuration | | | 1 | SSB.1 FR1 | |
| | | | 2 | SSB.1 FR1 | |
| | | | 3 | SSB.2 FR1 | |
| SMTC configuration | | | 1 | SMTC pattern 2 | |
| | | | 2 | SMTC pattern 1 | |
| | | | 3 | SMTC pattern 1 | |
| DRX cycle length | | s | 1, 2, 3 | 1.28 | The value shall be used for all cells in the test. |
| PRACH configuration index | | | 1, 2, 3 | 87 | The detailed configuration is specified in TS 38.211 clause 6.3.3.2 |
| rangeToBestCell | | | 1, 2, 3 | Not configured | |
| T1 | | s | 1, 2, 3 | TBD | T1 needs to be defined so that cell re-selection reaction time is taken into account. |
| T2 | | s | 1, 2, 3 | >7 | During T2, cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that cell 2 has not been detected by the UE prior to the start of period T3. |
| T3 | | s | 1, 2, 3 | TBD | T3 needs to be defined so that cell re-selection reaction time is taken into account. |

**Table A.6.1.1.2.2-3: Cell specific test parameters for FR1 inter frequency NR cell re-selection test case in AWGN**

| Parameter | Unit | Test configuration | Cell 1 | | | Cell 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| TDD configuration | | 1 | N/A | | | N/A | | |
| | | 2 | TDDConf.1.1 | | | TDDConf.1.1 | | |
| | | 3 | TDDConf.2.1 | | | TDDConf.2.1 | | |
| PDSCH RMC configuration | | 1 | SR.1.1 FDD | | | N/A | | |
| | | 2 | SR.1.1 TDD | | | | | |
| | | 3 | SR.2.1 TDD | | | | | |
| RMSI CORESET RMC configuration | | 1 | CR.1.1 FDD | | | CR.1.1 FDD | | |
| | | 2 | CR.1.1 TDD | | | CR.1.1 TDD | | |
| | | 3 | CR.2.1 TDD | | | CR.2.1 TDD | | |
| Dedicated CORESET RMC configuration | | 1 | CCR.1.1 FDD | | | CCR.1.1 FDD | | |
| | | 2 | CCR.1.1 TDD | | | CCR.1.1 TDD | | |
| | | 3 | CCR.2.1 TDD | | | CCR.2.1 TDD | | |
| OCNG Pattern | | 1, 2, 3 | OP.1 defined in A.3.2.1 | | | OP.1 defined in A.3.2.1 | | |
| Initial DL BWP configuration | | 1, 2, 3 | DLBWP.0 | | | DLBWP.0 | | |
| Initial UL BWP configuration | | 1, 2, 3 | ULBWP.0 | | | ULBWP.0 | | |
| RLM-RS | | 1, 2, 3 | SSB | | | SSB | | |
| Qrxlevmin | dBm/SCS | 1, 2 | -140 | | | -140 | | |
| | | 3 | -137 | | | -137 | | |
| Pcompensation | dB | 1, 2, 3 | 0 | | | 0 | | |
| $Qhyst_s$ | dB | 1, 2, 3 | 0 | | | 0 | | |
| $Qoffset_{s,n}$ | dB | 1, 2, 3 | 0 | | | 0 | | |
| Cell_selection_and_reselection_quality_measurement | | 1, 2, 3 | SS-RSRP | | | SS-RSRP | | |
| $\hat{E}_s/I_{ot}$ | dB | 1 | 14 | 14 | 14 | -4 | -infinity | 12 |
| | | 2 | | | | | | |
| | | 3 | | | | | | |
| $N_{oc}$ Note2 | dBm/SCS | 1 | -98 | | | | | |
| | | 2 | -98 | | | | | |
| | | 3 | -95 | | | | | |
| $N_{oc}$ Note2 | dBm/15 kHz | 1 | -98 | | | | | |
| | | 2 | | | | | | |
| | | 3 | | | | | | |
| $\hat{E}_s/N_{oc}$ | dB | 1 | 14 | 14 | 14 | -4 | -infinity | 12 |
| | | 2 | | | | | | |
| | | 3 | | | | | | |
| SS-RSRP Note3 | dBm/SCS | 1 | -84 | -84 | -84 | -102 | -infinity | -86 |
| | | 2 | -84 | -84 | -84 | -102 | -infinity | -86 |
| | | 3 | -81 | -81 | -81 | -99 | -infinity | -83 |
| Io | dBm/9.36 MHz | 1 | -55.88 | -55.88 | -55.88 | -68.60 | -infinity | -57.78 |
| | dBm/9.36 MHz | 2 | -55.88 | -55.88 | -55.88 | -68.60 | -infinity | -57.78 |
| | dBm/38.16 MHz | 3 | -49.79 | -49.79 | -49.79 | -62.50 | -infinity | -51.69 |
| Treselection | s | 1, 2, 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Snonintrasearch | dB | 1, 2, 3 | 50 | | | Not sent | | |
| $Thresh_{x, high}$ | dB | 1, 2, 3 | 48 | | | 48 | | |
| $Thresh_{serving, low}$ | dB | 1, 2, 3 | 44 | | | 44 | | |
| $Thresh_{x, low}$ | dB | 1, 2, 3 | 50 | | | 50 | | |
| Propagation Condition | | 1, 2, 3 | AWGN | | | | | |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.

Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

#### A.6.1.1.2.3 Test Requirements

The cell reselection delay to a higher priority cell is defined as the time from the beginning of time period T3, to the moment when the UE camps again on cell 2, and starts to send preambles on the PRACH for sending the RRC CONNECTION REQUEST message to perform a Tracking Area Update procedure on cell 2.

The cell re-selection delay to a higher priority cell shall be less than TBD s.

The cell reselection delay to a lower priority cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on cell 1, and starts to send preambles on the PRACH for sending the RRC CONNECTION REQUEST message to perform a Tracking Area Update procedure on cell 1.

The cell re-selection delay to a lower priority cell shall be less than TBD s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher\_priority\_search}$ + $T_{evaluate,\ NR\_ inter}$ + $T_{SI-NR}$, and to a lower priority cell can be expressed as: $T_{evaluate,\ NR\_ inter}$ + $T_{SI-NR}$,

Where:

$T_{higher\_priority\_search}$ See clause 4.2.2.7

$T_{evaluate,\ NR\_ inter}$ See Table 4.2.2.4-1 in clause 4.2.2.4

$T_{SI-NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; TBD ms is assumed in this test case.

This gives a total of TBD s, allow TBD s for the cell re-selection delay to a higher priority cell and TBD s for the cell re-selection delay to a lower priority cell in the test case, which we allow TBD s.

## A.6.1.2 Inter-RAT E-UTRAN cell re-selection

### A.6.1.2.1 Cell reselection to higher priority E-UTRAN

#### A.6.1.2.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell reselection requirements specified in clause 4.2.2.5 when the E-UTRAN cell is of higher priority.

#### A.6.1.2.1.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.6.1.2.1.2-1, A.6.1.2.1.2-2, A.6.1.2.1.2-3 and A.6.1.2.1.2-4. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. NR cell 1 is already identified by the UE prior to the start of the test. E-UTRAN cell 2 is of higher priority than cell 1.

**Table A.6.1.2.1.2-1: Supported test configurations**

| Configuration | Description of serving cell | Description of target cell |
|---|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | LTE 10MHz bandwidth, TDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | LTE 10MHz bandwidth, TDD duplex mode |
| 3 | NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | LTE 10MHz bandwidth, TDD duplex mode |
| 4 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | LTE 10MHz bandwidth, FDD duplex mode |
| 5 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | LTE 10MHz bandwidth, FDD duplex mode |
| 6 | NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | LTE 10MHz bandwidth, FDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | | |

**Table A.6.1.2.1.2-2: General test parameters for NR to E-UTRAN cell re-selection test case**

| Parameter | | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|---|
| Initial condition | Active cell | | 1, 2, 3, 4, 5, 6 | Cell1 | The UE camps on cell 1 in the initial phase and during T2 period the UE reselects to cell 2. |
| T2 end condition | Active cell | | 1, 2, 3, 4, 5, 6 | Cell2 | The UE shall perform reselection to cell 2 during T2. |
| | Neighbour cells | | 1, 2, 3, 4, 5, 6 | Cell1 | |
| T3 end condition | Active cell | | 1, 2, 3, 4, 5, 6 | Cell1 | The UE shall perform reselection to cell 1 during T3 for iteration of the tests. |
| | Neighbour cells | | 1, 2, 3, 4, 5, 6 | Cell2 | |
| Access Barring Information | | - | 1, 2, 3, 4, 5, 6 | Not Sent | No additional delays in random access procedure. |
| DRX cycle length | | s | 1, 2, 3, 4, 5, 6 | 1.28 | The value shall be used for all cells in the test. |
| NR PRACH configuration index | | | 1, 2, 3, 4, 5, 6 | 87 | The detailed configuration is specified in TS 38.211 clause 6.3.3.2 |
| E-UTRAN PRACH configuration index | | | 1, 2, 3, 4, 5, 6 | 4 | As specified in table 5.7.1-2 in TS 36.211 |
| T1 | | s | 1, 2, 3, 4, 5, 6 | >7 | During T1, cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that cell 2 has not been detected by the UE prior to the start of period T2. |
| T2 | | s | 1, 2, 3, 4, 5, 6 | 75 | T2 needs to be defined so that cell re-selection reaction time is taken into account. |
| T3 | | s | 1, 2, 3, 4, 5, 6 | 15 | T3 needs to be defined so that cell re-selection reaction time is taken into account. |

**Table A.6.1.2.1.2-3: Cell specific test parameters for NR cell 1**

| Parameter | Unit | Test configuration | Cell 1 | | |
|---|---|---|---|---|---|
| | | | T1 | T2 | T3 |
| TDD configuration | | 1, 4 | N/A | | |
| | | 2, 5 | TDDConf.1.1 | | |
| | | 3, 6 | TDDConf.2.1 | | |
| PDSCH parameters | | 1, 4 | SR.1.1 FDD | | |
| | | 2, 5 | SR.1.1 TDD | | |
| | | 3, 6 | SR.2.1 TDD | | |
| RMSI CORESET parameters | | 1, 4 | CR.1.1 FDD | | |
| | | 2, 5 | CR.1.1 TDD | | |
| | | 3, 6 | CR.2.1 TDD | | |
| Dedicated CORESET parameters | | 1, 4 | CCR.1.1 FDD | | |
| | | 2, 5 | CCR.1.1 TDD | | |
| | | 3, 6 | CCR.2.1 TDD | | |
| SSB parameters | | 1, 4 | SSB.1 FR1 | | |
| | | 2, 5 | SSB.1 FR1 | | |
| | | 3, 6 | SSB.2 FR1 | | |
| NR SMTC parameters | | 1, 4 | SMTC pattern 2 | | |
| | | 2, 5 | SMTC pattern 1 | | |
| | | 3, 6 | SMTC pattern 1 | | |
| OCNG Pattern | | 1, 2, 3, 4, 5, 6 | OP.1 defined in A.3.2.1 | | |
| Initial DL BWP configuration | | 1, 2, 3, 4, 5, 6 | DLBWP.0 | | |
| Initial UL BWP configuration | | 1, 2, 3, 4, 5, 6 | ULBWP.0 | | |
| RLM-RS | | 1, 2, 3, 4, 5, 6 | SSB | | |
| Qrxlevmin | dBm/SCS | 1, 2, 4, 5 | -140 | | |
| | | 3, 6 | -137 | | |
| $N_{oc}$ | dBm/SCS | 1, 4 | -98 | | |
| | | 2, 5 | -98 | | |
| | | 3, 6 | -95 | | |

| | | | | | |
|---|---|---|---|---|---|
| $N_{oc}$ | dBm/15 kHz | 1, 2, 3, 4, 5, 6 | -98 | | |
| SS-RSRP | dBm/SCS | 1, 4 | -84 | -84 | -84 |
| | | 2, 5 | -84 | -84 | -84 |
| | | 3, 6 | -81 | -81 | -81 |
| $\hat{E}_s/I_{ot}$ | dB | 1, 4 | 14 | 14 | 14 |
| | | 2, 5 | | | |
| | | 3, 6 | | | |
| $\hat{E}_s/N_{oc}$ | dB | 1, 4 | 14 | 14 | 14 |
| | | 2, 5 | | | |
| | | 3, 6 | | | |
| Io | dBm/9.36 MHz | 1, 4 | -55.88 | -55.88 | -55.88 |
| | dBm/9.36 MHz | 2, 5 | -55.88 | -55.88 | -55.88 |
| | dBm/38.16 MHz | 3, 6 | -49.79 | -49.79 | -49.79 |
| Treselection | S | 1, 2, 3, 4, 5, 6 | 0 | | |
| Snonintrasearch | dB | 1, 2, 3, 4, 5, 6 | 50 | | |
| $Thresh_{x,\ high\ (Note\ 2)}$ | dB | 1, 2, 3, 4, 5, 6 | 48 | | |
| $Thresh_{serving,\ low}$ | dB | 1, 2, 3, 4, 5, 6 | 44 | | |
| $Thresh_{x,\ low}$ | dB | 1, 2, 3, 4, 5, 6 | 50 | | |
| Propagation Condition | | 1, 2, 3, 4, 5, 6 | AWGN | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: This refers to the value of $Thresh_{x,\ high}$ which is included in NR system information, and is a threshold for the E-UTRA target cell | | | | | |

**Table A.6.1.2.1.2-4: Cell specific test parameters for E-UTRA cell 2**

| Parameter | Unit | Cell 2 | | |
|---|---|---|---|---|
| | | T1 | T2 | T3 |

| | | | | |
|---|---|---|---|---|
| E-UTRA RF Channel number | | 1 | | |
| $BW_{channel}$ | MHz | 10 | | |
| OCNG Patterns defined in TS 36.133 clause A.3.2 | | OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6 | | |
| PBCH_RA | dB | 0 | | |
| PBCH_RB | dB | | | |
| PSS_RA | dB | | | |
| SSS_RA | dB | | | |
| PCFICH_RB | dB | | | |
| PHICH_RA | dB | | | |
| PHICH_RB | dB | | | |
| PDCCH_RA | dB | | | |
| PDCCH_RB | dB | | | |
| PDSCH_RA | dB | | | |
| PDSCH_RB | dB | | | |
| OCNG_RA Note 1 | dB | | | |
| OCNG_RB Note 1 | dB | | | |
| Qrxlevmin | dBm | -140 | | |
| $N_{oc}$ | dBm/15 kHz | -98 | | |
| RSRP | dBm/15 KHz | -infinity | -86 | -102 |
| $\hat{E}_s/I_{ot}$ | dB | -infinity | 12 | -4 |
| $\hat{E}_s/N_{oc}$ | dB | -infinity | 12 | -4 |
| $Treselection_{EUTRAN}$ | S | 0 | | |
| Snonintrasearch | dB | Not sent | | |
| $Thresh_{x, high}$ (Note 2) | dB | 48 | | |
| $Thresh_{serving, low}$ | dB | 44 | | |
| $Thresh_{x, low}$ | dB | 50 | | |
| Propagation Condition | | AWGN | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: This refers to the value of $Thresh_{x, high}$ which is included in E-UTRA system information, and is a threshold for the NR target cell | | | | |

#### A.6.1.2.1.3 Test Requirements

The cell reselection delay to a higher priority E-UTRAN cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on cell 2, and starts to send preambles on the PRACH for sending the RRC CONNECTION REQUEST message to perform a Tracking Area Update procedure on cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher\_priority\_search} + T_{evaluate, E-UTRAN} + T_{SI-E-UTRA}$,

Where:

$T_{higher\_priority\_search}$ See clause 4.2.2.7

$T_{evaluate, E-UTRAN}$ See Table 4.2.2.5-1 in clause 4.2.2.5

$T_{SI-E-UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority E-UTRAN cell.

### A.6.1.2.2 Cell reselection to lower priority E-UTRAN

#### A.6.1.2.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell reselection requirements specified in clause 4.2.2.5 when the E-UTRAN cell is of lower priority.

#### A.6.1.2.2.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.6.1.2.2.2-1, A.6.1.2.2.2-2, A.6.1.2.2.2-3 and A.6.1.2.2.2-4. The test consists of three successive time periods, with time duration of T1 and T2 respectively. Both NR cell 1 and E-UTRAN cell 2 are already identified by the UE prior to the start of the test. E-UTRAN cell 2 is of lower priority than cell 1.

**Table A.6.1.2.2.2-1: Supported test configurations**

| Configuration | Description of serving cell | Description of target cell |
|---|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | LTE 10MHz bandwidth, TDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | LTE 10MHz bandwidth, TDD duplex mode |
| 3 | NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | LTE 10MHz bandwidth, TDD duplex mode |
| 4 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | LTE 10MHz bandwidth, FDD duplex mode |
| 5 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | LTE 10MHz bandwidth, FDD duplex mode |
| 6 | NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | LTE 10MHz bandwidth, FDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | | |

**Table A.6.1.2.2.2-2: General test parameters for NR to E-UTRAN cell re-selection test case**

| Parameter | | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|---|
| Initial condition | Active cell | | 1, 2, 3, 4, 5, 6 | Cell2 | The UE camps on cell 1 in the initial phase. |
| T1 end condition | Active cell | | 1, 2, 3, 4, 5, 6 | Cell2 | The UE shall perform reselection to cell 2 during T1. |
| | Neighbour cells | | 1, 2, 3, 4, 5, 6 | Cell1 | |
| T2 end condition | Active cell | | 1, 2, 3, 4, 5, 6 | Cell1 | The UE shall perform reselection to cell 1 during T2 for iteration of the tests. |
| | Neighbour cells | | 1, 2, 3, 4, 5, 6 | Cell2 | |
| Access Barring Information | | - | 1, 2, 3, 4, 5, 6 | Not Sent | No additional delays in random access procedure. |
| DRX cycle length | | s | 1, 2, 3, 4, 5, 6 | 1.28 | The value shall be used for all cells in the test. |
| NR PRACH configuration index | | | 1, 2, 3, 4, 5, 6 | 87 | The detailed configuration is specified in TS 38.211 clause 6.3.3.2 |
| E-UTRAN PRACH configuration index | | | 1, 2, 3, 4, 5, 6 | 4 | As specified in table 5.7.1-2 in TS 36.211 |
| T1 | | s | 1, 2, 3, 4, 5, 6 | 15 | T1 needs to be defined so that cell re-selection reaction time is taken into account. |
| T2 | | s | 1, 2, 3, 4, 5, 6 | 75 | T2 needs to be defined so that cell re-selection reaction time is taken into account. |

**Table A.6.1.2.2.2-3: Cell specific test parameters for NR cell 1**

| Parameter | Unit | Test configuration | Cell 1 | |
|---|---|---|---|---|
| | | | T1 | T2 |
| TDD configuration | | 1, 4 | N/A | |
| | | 2, 5 | TDDConf.1.1 | |
| | | 3, 6 | TDDConf.2.1 | |
| PDSCH RMC configuration | | 1, 4 | SR.1.1 FDD | |
| | | 2, 5 | SR.1.1 TDD | |
| | | 3, 6 | SR.2.1 TDD | |
| RMSI CORESET RMC configuration | | 1, 4 | CR.1.1 FDD | |
| | | 2, 5 | CR.1.1 TDD | |
| | | 3, 6 | CR.2.1 TDD | |
| Dedicated CORESET RMC configuration | | 1, 4 | CCR.1.1 FDD | |
| | | 2, 5 | CCR.1.1 TDD | |
| | | 3, 6 | CCR.2.1 TDD | |
| SSB configuration | | 1, 4 | SSB.1 FR1 | |
| | | 2, 5 | SSB.1 FR1 | |
| | | 3, 6 | SSB.2 FR1 | |
| SMTC configuration | | 1, 4 | SMTC pattern 2 | |
| | | 2, 5 | SMTC pattern 1 | |
| | | 3, 6 | SMTC pattern 1 | |
| OCNG Pattern | | 1, 2, 3, 4, 5, 6 | OP.1 defined in A.3.2.1 | |
| Initial DL BWP configuration | | 1, 2, 3, 4, 5, 6 | DLBWP.0 | |
| Initial UL BWP configuration | | 1, 2, 3, 4, 5, 6 | ULBWP.0 | |
| RLM-RS | | 1, 2, 3, 4, 5, 6 | SSB | |
| Qrxlevmin | dBm/SCS | 1, 2, 4, 5 | -140 | |
| | | 3, 6 | -137 | |
| $N_{oc}$ | dBm/SCS | 1, 4 | -98 | |
| | | 2, 5 | -98 | |
| | | 3, 6 | -95 | |
| $N_{oc}$ | dBm/15 kHz | 1, 2, 3, 4, 5, 6 | -98 | |
| SS-RSRP | dBm/SCS | 1, 4 | -102 | -86 |
| | | 2, 5 | -102 | -86 |
| | | 3, 6 | -99 | -83 |
| $\hat{E}_s/I_{ot}$ | dB | 1, 4 | -4 | 12 |
| | | 2, 5 | | |
| | | 3, 6 | | |
| $\hat{E}_s/N_{oc}$ | dB | 1, 4 | -4 | 12 |
| | | 2, 5 | | |
| | | 3, 6 | | |
| Io | dBm/9.36 MHz | 1, 4 | -68.60 | -57.78 |
| | dBm/9.36 MHz | 2, 5 | -68.60 | -57.78 |
| | dBm/38.16 MHz | 3, 6 | -62.50 | -51.69 |
| Treselection | S | 1, 2, 3, 4, 5, 6 | 0 | |
| Snonintrasearch | dB | 1, 2, 3, 4, 5, 6 | 50 | |
| $\text{Thresh}_{\text{x, high (Note 2)}}$ | dB | 1, 2, 3, 4, 5, 6 | 48 | |
| $\text{Thresh}_{\text{serving, low}}$ | dB | 1, 2, 3, 4, 5, 6 | 44 | |
| $\text{Thresh}_{\text{x, low}}$ | dB | 1, 2, 3, 4, 5, 6 | 50 | |
| Propagation Condition | | 1, 2, 3, 4, 5, 6 | AWGN | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: This refers to the value of $\text{Thresh}_{\text{x, high}}$ which is included in NR system information, and is a threshold for the E-UTRA target cell | | | | |

**Table A.6.1.2.2.2-4: Cell specific test parameters for E-UTRA cell 2**

| Parameter | Unit | Cell 2 | |
|---|---|---|---|
| | | T1 | T2<br>T3 |
| E-UTRA RF Channel number | | 1 | |
| $BW_{channel}$ | MHz | 10 | |
| OCNG Patterns defined in TS 36.133 clause A.3.2 | | OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6 | |
| PBCH_RA | dB | 0 | |
| PBCH_RB | dB | | |
| PSS_RA | dB | | |
| SSS_RA | dB | | |
| PCFICH_RB | dB | | |
| PHICH_RA | dB | | |
| PHICH_RB | dB | | |
| PDCCH_RA | dB | | |
| PDCCH_RB | dB | | |
| PDSCH_RA | dB | | |
| PDSCH_RB | dB | | |
| OCNG_RA Note 1 | dB | | |
| OCNG_RB Note 1 | dB | | |
| Qrxlevmin | dBm | -140 | |
| $N_{oc}$ | dBm/15 kHz | -98 | |
| RSRP | dBm/15 KHz | -84 | -84 |
| $\hat{E}_s/I_{ot}$ | dB | 14 | 14 |
| $\hat{E}_s/N_{oc}$ | dB | 14 | 14 |
| $Treselection_{EUTRAN}$ | S | 0 | |
| Snonintrasearch | dB | Not sent | |
| $Thresh_{x, high}$ (Note 2) | dB | 48 | |
| $Thresh_{serving, low}$ | dB | 44 | |
| $Thresh_{x, low}$ | dB | 50 | |
| Propagation Condition | | AWGN | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: This refers to the value of $Thresh_{x, high}$ which is included in E-UTRA system information, and is a threshold for the NR target cell | | | |

### A.6.1.2.2.3 Test Requirements

The cell reselection delay to a lower priority E-UTRAN cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on cell 2, and starts to send preambles on the PRACH for sending the RRC CONNECTION REQUEST message to perform a Tracking Area Update procedure on cell 2.

The cell re-selection delay to a lower priority cell shall be less than 8 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate, E-UTRAN} + T_{SI-E-UTRA}$,

Where:

$T_{evaluate, E-UTRAN}$ See Table 4.2.2.5-1 in clause 4.2.2.5

$T_{SI-E-UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 7.68 s, allow 8 s for the cell re-selection delay to a lower priority E-UTRAN cell.

## A.6.2 SA: RRC_INACTIVE state mobility

## A.6.3 RRC_CONNECTED state mobility

### A.6.3.1 Handover

#### A.6.3.1.1 Intra-frequency handover from FR1 to FR1; known target cell

##### A.6.3.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra frequency handover requirements specified in clause 6.1.1.2 [v15.2.1].

##### A.6.3.1.1.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.6.3.1.1.2-2, and A.6.3.1.1.2-3.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE may not have any timing information of cell 2.

NR shall send a RRC message implying handover to cell 2. The RRC message implying handover shall be sent to the UE during period T2, after the UE has reported Event A3. T3 is defined as the end of the last TTI containing the RRC message implying handover.

**Table A.6.3.1.1.2-1: Intra-frequency handover from FR1 to FR1 test configurations**

| Config | Description |
|---|---|
| 1 | Source cell: NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode<br>Target cell: NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | Source cell: NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode<br>Target cell: NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | Source cell: NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode<br>Target cell: NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.6.3.1.1.2-2: General test parameters Intra-frequency handover from FR1 to FR1**

| Parameter | | Unit | Value | Comment |
|---|---|---|---|---|
| Initial conditions | Active cell | | Cell 1 | |
| | Neighbouring cell | | Cell 2 | |
| Final condition | Active cell | | Cell 2 | |
| A3-Offset | | dB | 0 | |
| Hysteresis | | dB | 0 | |
| Time To Trigger | | s | 0 | |
| Filter coefficient | | | 0 | L3 filtering is not used |
| Access Barring Information | | - | Not Sent | No additional delays in random access procedure. |
| PRACH configuration index | | | TBD | As specified in table Table 6.3.3.2-3 in TS 38.211 |
| Time offset between cells | | | 3 μs | Synchronous cells |
| T1 | | s | 5 | |
| T2 | | s | ≤5 | |
| T3 | | s | 1 | |

**Table A.6.3.1.1.2-3: Cell specific test parameters for NR FR1-FR1 Intra frequency handover test case**

| Parameter | Unit | Cell 1 | | | Cell 2 | | |
|---|---|---|---|---|---|---|---|
| | | T1 | T2 | T3 | T1 | T2 | T3 |
| NR RF Channel Number | | 1 | | | 1 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Duplex mode | Config 1 | | FDD | | | | | |
| | Config 2,3 | | TDD | | | | | |
| TDD configuration | Config 1 | | Not Applicable | | | | | |
| | Config 2 | | TDDConf.1.1 | | | | | |
| | Config 3 | | TDDConf.2.1 | | | | | |
| $BW_{channel}$ | Config 1 | MHz | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 2 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 3 | | 40: $N_{RB,c}$ = 106 | | | | | |
| BWP BW | Config 1 | MHz | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 2 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 3 | | 40: $N_{RB,c}$ = 106 | | | | | |
| DRx Cycle | | ms | Not Applicable | | | | | |
| PDSCH Reference measurement channel | Config 1 | | SR.1.1 FDD | | | | | |
| | Config 2 | | SR.1.1 TDD | | | | | |
| | Config 3 | | SR2.1 TDD | | | | | |
| CORESET Reference Channel | Config 1 | | CR.1.1 FDD | | | | | |
| | Config 2 | | CR.1.1 TDD | | | | | |
| | Config 3 | | CR2.1 TDD | | | | | |
| OCNG Patterns | | | OCNG pattern 1 | | | | | |
| SMTC configuration | Config 1,2 | | SMTC.1 FR1 | | | | | |
| | Config 3 | | SMTC.2 FR1 | | | | | |
| PDSCH/PDCCH subcarrier spacing | Config 1,2 | kHz | 15 kHz | | | | | |
| | Config 3 | | 30 kHz | | | | | |
| PUCCH/PUSCH subcarrier spacing | Config 1,2 | kHz | 15 kHz | | | | | |
| | Config 3 | | 30 kHz | | | | | |
| PRACH configuration | | | FR1 PRACH configuration 1 | | | | | |
| TRS configuration | | | TBD | | | | | |
| BWP configuraiton | Initial DL BWP | | DLBWP.0.1 | | | | | |
| | Dedicated DL BWP | | DLBWP.1.1 | | | | | |
| | Initial UL BWP | | ULBWP.0.1 | | | | | |
| | Dedicated UL BWP | | ULBWP.1.1 | | | | | |
| EPRE ratio of PSS to SSS | | dB | 0 | | | | | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | | |
| $N_{oc}$ Note2 | | dBm/15kHz | -98 | | | | | |
| $N_{oc}$ Note2 | Config 1,2 | dBm/SCS | -98 | | | | | |
| | Config 3 | | -95 | | | | | |
| $\hat{E}_s/I_{ot}$ | | dB | 8 | -3.3 | -3.3 | -Infinity | 2.36 | 2.36 |
| $\hat{E}_s/N_{oc}$ | | dB | 8 | 8 | 8 | -Infinity | 11 | 11 |
| Io Note3 | Config 1,2 | dBm/9.36MHz | -64.7 | -60.87 | -60.87 | -64.7 | -60.87 | -60.87 |
| | Config 3 | dBm/38.16MHz | -60.55 | -57.36 | -57.36 | -60.55 | -57.36 | -57.36 |
| Propagation condition | | - | AWGN | | | | | |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.

Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

#### A.6.3.1.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than [TBD] ms from the beginning of time period T3.
The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = [TBD] ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = [TBD] ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2 [TS38.133].

This gives a total of [TBD] ms.

### A.6.3.1.2 Intra-frequency handover from FR1 to FR1; unknown target cell

#### A.6.3.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra frequency handover requirements specified in clause 6.1.1.2 [v15.2.1].

#### A.6.3.1.2.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.2.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.6.3.1.2.2-2, and A.6.3.1.2.2-3.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. Starting T2, cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

**Table A.6.3.1.2.2-1: Intra-frequency handover from FR1 to FR1 test configurations**

| Config | Description |
|---|---|
| 1 | Source cell: NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode<br>Target cell: NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | Source cell: NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode<br>Target cell: NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | Source cell: NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode<br>Target cell: NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.6.3.1.2.2-2: General test parameters Intra-frequency handover from FR1 to FR1**

| Parameter | | Unit | Value | Comment |
|---|---|---|---|---|
| Initial conditions | Active cell | | Cell 1 | |
| | Neighbouring cell | | Cell 2 | |
| Final condition | Active cell | | Cell 2 | |
| A3-Offset | | dB | 0 | |
| Hysteresis | | dB | 0 | |
| Time To Trigger | | s | 0 | |
| Filter coefficient | | | 0 | L3 filtering is not used |
| Access Barring Information | | - | Not Sent | No additional delays in random access procedure. |
| PRACH configuration index | | | TBD | As specified in table Table 6.3.3.2-3 in TS 38.211 |
| Time offset between cells | | | 3 μs | Synchronous cells |
| T1 | | s | 5 | |
| T2 | | s | ≤5 | |
| T3 | | s | 1 | |

**Table A.6.3.1.2.2-3: Cell specific test parameters for NR FR1-FR1 Intra frequency handover test case**

| Parameter | Unit | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|
| | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | 1 | | 1 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Duplex mode | Config 1 | | FDD | | | |
| | Config 2,3 | | TDD | | | |
| TDD configuration | Config 1 | | Not Applicable | | | |
| | Config 2 | | TDDConf.1.1 | | | |
| | Config 3 | | TDDConf. 2.1 | | | |
| $BW_{channel}$ | Config 1 | MHz | 10: $N_{RB,c}$ = 52 | | | |
| | Config 2 | | 10: $N_{RB,c}$ = 52 | | | |
| | Config 3 | | 40: $N_{RB,c}$ = 106 | | | |
| BWP BW | Config 1 | MHz | 10: $N_{RB,c}$ = 52 | | | |
| | Config 2 | | 10: $N_{RB,c}$ = 52 | | | |
| | Config 3 | | 40: $N_{RB,c}$ = 106 | | | |
| DRx Cycle | | ms | Not Applicable | | | |
| PDSCH Reference measurement channel | Config 1 | | SR.1.1 FDD | | | |
| | Config 2 | | SR.1.1 TDD | | | |
| | Config 3 | | SR2.1 TDD | | | |
| CORESET Reference Channel | Config 1 | | CR.1.1 FDD | | | |
| | Config 2 | | CR.1.1 TDD | | | |
| | Config 3 | | CR2.1 TDD | | | |
| OCNG Patterns | | | OCNG pattern 1 | | | |
| SMTC configuration | Config 1,2 | | SMTC.1 FR1 | | | |
| | Config 3 | | SMTC.2 FR1 | | | |
| PDSCH/PDCCH subcarrier spacing | Config 1,2 | kHz | 15 kHz | | | |
| | Config 3 | | 30 kHz | | | |
| PUCCH/PUSCH subcarrier spacing | Config 1,2 | kHz | 15 kHz | | | |
| | Config 3 | | 30 kHz | | | |
| PRACH configuration | | | FR1 PRACH configuration 1 | | | |
| TRS configuration | | | TBD | | | |
| BWP configuration | Initial DL BWP | | DLBWP.0.1 | | | |
| | Dedicated DL BWP | | DLBWP.1.1 | | | |
| | Initial UL BWP | | ULBWP.0.1 | | | |
| | Dedicated UL BWP | | ULBWP.1.1 | | | |
| EPRE ratio of PSS to SSS | | dB | 0 | | | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| $N_{oc}$ Note2 | | dBm/15kHz | -98 | | | |
| $N_{oc}$ Note2 | Config 1,2 | dBm/SCS | -98 | | | |
| | Config 3 | | -95 | | | |
| $\hat{E}_s/I_{ot}$ | | dB | 8 | 8 | -Infinity | 8 |

| | | | | | | |
|---|---|---|---|---|---|---|
| $\hat{E}_s/N_{oc}$ | | dB | 8 | 8 | -Infinity | 8 |
| Io[Note3] | Config 1,2 | dBm/ 9.36MHz | -64.7 | -60.87 | -64.7 | -60.87 |
| | Config 3 | dBm/ 38.16MHz | -60.55 | -57.36 | -60.55 | -57.36 |
| Propagation condition | | - | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | |

#### A.6.3.1.2.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than [TBD] ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = [TBD] ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = [TBD] ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2 [TS38.133].

This gives a total of [TBD] ms.

### A.6.3.1.3 Inter-frequency handover from FR1 to FR1; unknown target cell

#### A.6.3.1.3.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 inter frequency handover requirements specified in clause 6.1.1.2 [TS38.133].

#### A.6.3.1.3.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.3.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.6.3.1.3.2-2, and A.6.3.1.3.2-3.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. Starting T2, cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

**Table A.6.3.1.3.2-1: Inter-frequency handover from FR1 to FR1 test configurations**

| Config | Description |
|---|---|
| 1 | Source cell: NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode<br>Target cell: NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | Source cell: NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode<br>Target cell: NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | Source cell: NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode<br>Target cell: NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.6.3.1.3.2-2: General test parameters Inter-frequency handover from FR1 to FR1**

| Parameter | | Unit | Value | Comment |
|---|---|---|---|---|
| Initial conditions | Active cell | | Cell 1 | |
| | Neighbouring cell | | Cell 2 | |
| Final condition | Active cell | | Cell 2 | |
| A3-Offset | | dB | -4 | |
| Hysteresis | | dB | 0 | |
| Time To Trigger | | s | 0 | |
| Filter coefficient | | | 0 | L3 filtering is not used |
| Access Barring Information | | - | Not Sent | No additional delays in random access procedure. |
| T1 | | s | 5 | |
| T2 | | s | ≤5 | |
| T3 | | s | 1 | |

**Table A.6.3.1.3.2-3: Cell specific test parameters for NR FR1-FR1 Inter frequency handover test case**

| Parameter | Unit | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|
| | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | 1 | | 2 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Duplex mode | Config 1 | | FDD | | | |
| | Config 2,3 | | TDD | | | |
| TDD configuration | Config 1 | | Not Applicable | | | |
| | Config 2 | | TDDConf.1.1 | | | |
| | Config 3 | | TDDConf.2.1 | | | |
| $BW_{channel}$ | Config 1 | MHz | 10: $N_{RB,c}$ = 52 | | | |
| | Config 2 | | 10: $N_{RB,c}$ = 52 | | | |
| | Config 3 | | 40: $N_{RB,c}$ = 106 | | | |
| BWP BW | Config 1 | MHz | 10: $N_{RB,c}$ = 52 | | | |
| | Config 2 | | 10: $N_{RB,c}$ = 52 | | | |
| | Config 3 | | 40: $N_{RB,c}$ = 106 | | | |
| DRx Cycle | | ms | Not Applicable | | | |
| PDSCH Reference measurement channel | Config 1 | | SR.1.1 FDD | | | |
| | Config 2 | | SR.1.1 TDD | | | |
| | Config 3 | | SR2.1 TDD | | | |
| CORESET Reference Channel | Config 1 | | CR.1.1 FDD | | | |
| | Config 2 | | CR.1.1 TDD | | | |
| | Config 3 | | CR2.1 TDD | | | |
| OCNG Patterns | | | OCNG pattern 1 | | | |
| SMTC configuration | Config 1,2 | | SMTC.1 FR1 | | | |
| | Config 3 | | SMTC.2 FR1 | | | |
| PDSCH/PDCCH subcarrier spacing | Config 1,2 | kHz | 15 kHz | | | |
| | Config 3 | | 30 kHz | | | |
| PUCCH/PUSCH subcarrier spacing | Config 1,2 | kHz | 15 kHz | | | |
| | Config 3 | | 30 kHz | | | |
| PRACH configuration | | | FR1 PRACH configuration 1 | | | |
| TRS configuration | | | TBD | | | |
| BWP | Initial DL BWP | | DLBWP.0.1 | | | |
| | Dedicated DL BWP | | DLBWP.1.1 | | | |
| | Initial UL BWP | | ULBWP.0.1 | | | |
| | Dedicated UL BWP | | ULBWP.1.1 | | | |
| EPRE ratio of PSS to SSS | | dB | 0 | | | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| $N_{oc}$ Note2 | | dBm/15kHz | -98 | | | |
| $N_{oc}$ Note2 | Config 1,2 | dBm/SCS | -98 | | | |
| | Config 3 | | -95 | | | |
| $\hat{E}_s/I_{ot}$ | | dB | 4 | 4 | -Infinity | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| $\hat{E}_s/N_{oc}$ | | dB | 4 | 4 | -Infinity | 5 |
| Io[Note3] | Config 1,2 | dBm/ 9.36MHz | -67.11 | -67.11 | -70.05 | -66.59 |
| | Config 3 | dBm/ 38.16MHz | -62.27 | -62.27 | -63.96 | -61.92 |
| Propagation condition | | - | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | |

### A.6.3.1.3.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than [TBD] ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = [TBD] ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = [TBD] ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2 [TS38.133].

This gives a total of [TBD] ms.

## A.6.3.1.4 SA NR - E-UTRAN handover

### A.6.3.1.4.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct inter-RAT E-UTRAN handover when operating in standalone (SA) operation with PCell in FR1. This test shall verify the NR to E-UTRAN handover requirements as specified in section 6.1.2.1.

The test comprises of one NR carrier and one E-UTRA carrier. There are two cells and one cell on each carrier. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement report. Gap pattern configuration with id #0 as specified in Table 9.1.2-1 is configured before T2 begins to enable inter-RAT frequency monitoring.

A RRC message implying handover shall be sent to the UE during period T2 after the UE has reported Event B2. The start of T3 is the instant when the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.6.3.1.4-1. General test parameters are provided in Table A.6.3.1.4-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in Tables A.6.3.1.4-3 and A.6.3.1.4-4 respectively.

**Table A.6.3.1.4-1: Supported test configurations for SA inter-RAT E-UTRAN handover tests**

| Configuration | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode, LTE FDD |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode, LTE FDD |
| 3 | NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode, LTE FDD |
| 4 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode, LTE TDD |
| 5 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode, LTE TDD |
| 6 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode, LTE TDD |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.6.3.1.4-2: General test parameters for SA inter-RAT E-UTRAN handover**

| Parameter | | Unit | Value | Comment |
|---|---|---|---|---|
| NR RF Channel Number | | | 1 | 1 NR carrier frequency is used in the test |
| LTE RF Channel Number | | | 2 | 1 E-UTRAN carrier frequency is used in the test |
| Initial conditions | Active cell | | Cell 1 | NR cell |
| | Neighbouring cell | | Cell 2 | E-UTRAN cell |
| Final condition | Active cell | | Cell 2 | |
| NR measurement quantity | | | SS-RSRP | |
| E-UTRAN measurement quantity | | | RSRP | |
| b2-Threshold1 | | dBm | As specified in Table A.6.3.1.4-3 | Absolute NR SS-RSRP threshold for event B2 |
| b2-Threshold2EUTRAN | | dBm | -98 | Absolute E-UTRAN RSRP threshold for event B2 |
| Hysteresis | | dB | 0 | |
| TimeToTrigger | | s | 0 | |
| Filter coefficient | | | 0 | L3 filtering is not used |
| DRX | | | OFF | Non-DRX test |
| Access Barring Information | | - | Not sent | No additional delays in random access procedure |
| Time offset between cells | | | 3 ms | Asynchronous cells |
| Gap pattern configuration Id | | | 0 | As specified in Table 9.1.2-1 started before T2 starts |
| T1 | | s | 5 | |
| T2 | | s | ≤5 | |
| T3 | | s | 1 | |

**Table A.6.3.1.4-3: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 1)**

| Parameter | Unit | Configuration | Cell 1 | | |
|---|---|---|---|---|---|
| | | | T1 | T2 | T3 |
| RF channel number | | 1, 2, 3, 4, 5, 6 | 1 | | |
| Duplex mode | | 1, 4 | FDD | | |
| | | 2, 3, 5, 6 | TDD | | |
| TDD Configuration | | 2, 5 | TDDConf.1.1 | | |
| | | 3, 6 | TDDConf.1.2 | | |
| $BW_{channel}$ | MHz | 1, 4 | 10: $N_{RB,c}$ = 52 (FDD) | | |
| | | 2, 5 | 10: $N_{RB,c}$ = 52 (TDD) | | |
| | | 3, 6 | 40: $N_{RB,c}$ = 106 (TDD) | | |
| PDSCH reference measurement channel | | 1, 4 | SR.1.1 FDD | | |
| | | 2, 5 | SR.1.1 TDD | | |
| | | 3, 6 | SR.2.1 TDD | | |
| CORSET reference channel | | 1, 4 | CR.1.1 FDD | | |
| | | 2, 5 | CR.1.1 TDD | | |
| | | 3, 6 | CR.2.1 TDD | | |
| OCNG pattern Note1 | | 1, 2, 3, 4, 5, 6 | OP.1 | | |
| SMTC configuration | | 1, 2, 3, 4, 5, 6 | SMTC.1 | | |
| SSB configuration | | 1, 2, 4, 5 | SSB.1 FR1 | | |
| | | 3, 6 | SSB.2 FR1 | | |
| b2-Threshold1 | dBm | 1, 2, 4, 5 | -90 | | |
| | | 3, 6 | -87 | | |
| EPRE ratio of PSS to SSS | dB | 1, 2, 3, 4, 5, 6 | 0 | | |
| EPRE ratio of PBCH_DMRS to SSS | | | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | | | |
| EPRE ratio of OCNG DMRS to SSS | | | | | |
| EPRE ratio of OCNG to OCNG DMRS | | | | | |
| $N_{oc}$ Note2 | dBm/15 KHz | 1, 2, 3, 4, 5, 6 | -98 | | |
| $N_{oc}$ Note2 | dBm/SCS | 1, 2, 4, 5 | -98 | | |
| | | 3, 6 | -95 | | |
| $\hat{E}_s/N_{oc}$ | dB | 1, 2, 3, 4, 5, 6 | 0 | 0 | 0 |
| $\hat{E}_s/I_{ot}$ Note3 | dB | 1, 2, 3, 4, 5, 6 | 0 | 0 | 0 |
| SS-RSRP Note3 | dBm/SCS | 1, 2, 4, 5 | -98 | -98 | -98 |
| | | 3, 6 | -95 | -95 | -95 |
| Io Note3 | dBm/9.36 MHz | 1, 2, 4, 5 | -67.04 | -67.04 | -67.04 |
| | dBm/38.16 MHz | 3, 6 | -60.94 | -60.94 | -60.94 |
| Propagation condition | | 1, 2, 3, 4, 5, 6 | AWGN | | |
| Antenna Configuration and Correlation Matrix | | 1, 2, 3, 4, 5, 6 | 1x2 Low | | |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

**Table A.6.3.1.4-4: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 2)**

| Parameter | Unit | Configuration | Cell 2 | | |
|---|---|---|---|---|---|
| | | | T1 | T2 | T3 |
| RF channel number | | 1, 2, 3, 4, 5, 6 | 2 | | |
| Duplex mode | | 1, 2, 3 | FDD | | |
| | | 4, 5, 6 | TDD | | |
| TDD special subframe configuration[Note1] | | 4, 5, 6 | 6 | | |
| TDD uplink-downlink configuration[Note1] | | 4, 5, 6 | 1 | | |
| $BW_{channel}$ | MHz | 1, 2, 3, 4, 5, 6 | 5MHz: $N_{RB,c}$ = 25<br>10MHz: $N_{RB,c}$ = 50<br>20MHz: $N_{RB,c}$ = 100 | | |
| PRACH Configuration[Note2] | | 1, 2, 3 | 4 | | |
| | | 4, 5, 6 | 53 | | |
| PDSCH parameters:<br>DL Reference Measurement Channel[Note3] | | 1, 2, 3 | 5MHz: R.7 FDD<br>10MHz: R.3 FDD<br>20MHz: R.6 FDD | | |
| | | 4, 5, 6 | 5MHz: R.4 TDD<br>10MHz: R.0 TDD<br>20MHz: R.3 TDD | | |
| PCFICH/PDCCH/PHICH parameters:<br>DL Reference Measurement Channel[Note3] | | 1, 2, 3 | 5MHz: R.11 FDD<br>10MHz: R.6 FDD<br>20MHz: R.10 FDD | | |
| | | 4, 5, 6 | 5MHz: R.11 TDD<br>10MHz: R.6 TDD<br>20MHz: R.10 TDD | | |
| OCNG Patterns[Note3] | | 1, 2, 3 | 5MHz: OP.20 FDD<br>10MHz: OP.10 FDD<br>20MHz: OP.17 FDD | | |
| | | 4, 5, 6 | 5MHz: OP.9 TDD<br>10MHz: OP.1 TDD<br>20MHz: OP.7 TDD | | |
| PBCH_RA | dB | 1, 2, 3, 4, 5, 6 | 0 | | |
| PBCH_RB | | | | | |
| PSS_RA | | | | | |
| SSS_RA | | | | | |
| PCFICH_RB | | | | | |
| PHICH_RA | | | | | |
| PHICH_RB | | | | | |
| PDCCH_RA | | | | | |
| PDCCH_RB | | | | | |
| PDSCH_RA | | | | | |
| PDSCH_RB | | | | | |
| OCNG_RA[Note4] | | | | | |
| OCNG_RB[Note4] | | | | | |
| $N_{oc}$[Note5] | dBm/15kHz | 1, 2, 3, 4, 5, 6 | -98 | | |
| $\hat{E}_s/N_{oc}$ | dB | 1, 2, 3, 4, 5, 6 | -Infinity | 7 | 7 |
| $\hat{E}_s/I_{ot}$[Note6] | dB | 1, 2, 3, 4, 5, 6 | -Infinity | 7 | 7 |
| RSRP[Note6] | dBm/15kHz | 1, 2, 3, 4, 5, 6 | -Infinity | -91 | -91 |
| SCH_RP[Note6] | dBm/15kHz | 1, 2, 3, 4, 5, 6 | -Infinity | -91 | -91 |
| Io[Note6] | dBm/9MHz | 1, 2, 3, 4, 5, 6 | -70.22 | -62.43 | -62.43 |
| Propagation Condition | | 1, 2, 3, 4, 5, 6 | AWGN | | |
| Antenna Configuration and Correlation Matrix [Note7] | | 1, 2, 3, 4, 5, 6 | 1x2 Low | | |

Note 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211.
Note 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211.
Note 3: DL RMCs and OCNG patterns are specified in sections A 3.1 and A 3.2 of TS 36.133 respectively.
Note 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 7: Propagation condition and correlation matrix are defined in section B.2 in TS 36.101 [25].

#### A.6.3.1.4.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 85 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and is specified in section 6.1.2.1.

$T_{interrupt}$ = 35 ms in the test; $T_{interrupt}$ is defined in section 6.1.2.1.

This gives a total of 85 ms.

### A.6.3.1.5 SA NR - E-UTRAN handover with unknown target cell

#### A.6.3.1.5.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct inter-RAT E-UTRAN handover when operating in standalone (SA) operation with PCell in FR1. This test shall verify the NR to E-UTRAN handover requirements for the case when the target E-UTRAN cell is unknown as specified in section 6.1.2.1.

The test comprises of one NR carrier and one E-UTRA carrier. There are two cells and one cell on each carrier. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable. No Gap pattern shall be configured.

A RRC message implying handover shall be sent to the UE during period T1. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.6.3.1.5-1. General test parameters are provided in Table A.6.3.1.5-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in Tables A.6.3.1.5-3 and A.6.3.1.5-4 respectively.

**Table A.6.3.1.5-1: Supported test configurations for SA inter-RAT E-UTRAN handover tests**

| Configuration | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode, LTE FDD |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode, LTE FDD |
| 3 | NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode, LTE FDD |
| 4 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode, LTE TDD |
| 5 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode, LTE TDD |
| 6 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode, LTE TDD |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.6.3.1.5-2: General test parameters for SA inter-RAT E-UTRAN handover**

| Parameter | | Unit | Value | Comment |
|---|---|---|---|---|
| NR RF Channel Number | | | 1 | 1 NR carrier frequency is used in the test |
| LTE RF Channel Number | | | 2 | 1 E-UTRAN carrier frequency is used in the test |
| Initial conditions | Active cell | | Cell 1 | NR cell |
| | Neighbouring cell | | Cell 2 | E-UTRAN cell |
| Final condition | Active cell | | Cell 2 | |
| NR measurement quantity | | | SS-RSRP | |
| E-UTRAN measurement quantity | | | RSRP | |
| b2-Threshold1 | | dBm | As specified in Table A.6.3.1.5-3 | Absolute NR SS-RSRP threshold for event B2 |
| b2-Threshold2EUTRAN | | dBm | -98 | Absolute E-UTRAN RSRP threshold for event B2 |
| Hysteresis | | dB | 0 | |
| TimeToTrigger | | s | 0 | |
| Filter coefficient | | | 0 | L3 filtering is not used |
| DRX | | | OFF | Non-DRX test |
| Access Barring Information | | - | Not sent | No additional delays in random access procedure |
| Time offset between cells | | | 3 ms | Asynchronous cells |
| T1 | | s | ≤5 | |
| T2 | | s | 1 | |

**Table A.6.3.1.5-3: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 1)**

| Parameter | Unit | Configuration | Cell 1 | |
|---|---|---|---|---|
| | | | T1 | T2 |
| RF channel number | | 1, 2, 3, 4, 5, 6 | 1 | |
| Duplex mode | | 1, 4 | FDD | |
| | | 2, 3, 5, 6 | TDD | |
| TDD Configuration | | 2, 5 | TDDConf.1.1 | |
| | | 3, 6 | TDDConf.1.2 | |
| $BW_{channel}$ | MHz | 1, 4 | 10: $N_{RB,c}$ = 52 (FDD) | |
| | | 2, 5 | 10: $N_{RB,c}$ = 52 (TDD) | |
| | | 3, 6 | 40: $N_{RB,c}$ = 106 (TDD) | |
| PDSCH reference measurement channel | | 1, 4 | SR.1.1 FDD | |
| | | 2, 5 | SR.1.1 TDD | |
| | | 3, 6 | SR.2.1 TDD | |
| CORSET reference channel | | 1, 4 | CR.1.1 FDD | |
| | | 2, 5 | CR.1.1 TDD | |
| | | 3, 6 | CR.2.1 TDD | |
| OCNG pattern Note1 | | 1, 2, 3, 4, 5, 6 | OP.1 | |
| SMTC configuration | | 1, 2, 3, 4, 5, 6 | SMTC.1 | |
| SSB configuration | | 1, 2, 4, 5 | SSB.1 FR1 | |
| | | 3, 6 | SSB.2 FR1 | |
| b2-Threshold1 | dBm | 1, 2, 4, 5 | -90 | |
| | | 3, 6 | -87 | |
| EPRE ratio of PSS to SSS | dB | 1, 2, 3, 4, 5, 6 | 0 | |
| EPRE ratio of PBCH_DMRS to SSS | | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | | |
| EPRE ratio of OCNG DMRS to SSS | | | | |
| EPRE ratio of OCNG to OCNG DMRS | | | | |
| $N_{oc}$ Note2 | dBm/15 KHz | 1, 2, 3, 4, 5, 6 | -98 | |
| $N_{oc}$ Note2 | dBm/SCS | 1, 2, 4, 5 | -98 | |
| | | 3, 6 | -95 | |
| $\hat{E}_s/N_{oc}$ | dB | 1, 2, 3, 4, 5, 6 | 0 | 0 |
| $\hat{E}_s/I_{ot}$ Note3 | dB | 1, 2, 3, 4, 5, 6 | 0 | 0 |
| SS-RSRP Note3 | dBm/SCS | 1, 2, 4, 5 | -98 | -98 |
| | | 3, 6 | -95 | -95 |
| Io Note3 | dBm/9.36 MHz | 1, 2, 4, 5 | -67.04 | -67.04 |
| | dBm/38.16 MHz | 3, 6 | -60.94 | -60.94 |
| Propagation condition | | 1, 2, 3, 4, 5, 6 | AWGN | |
| Antenna Configuration and Correlation Matrix | | 1, 2, 3, 4, 5, 6 | 1x2 Low | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | |

**Table A.6.3.1.5-4: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 2)**

| Parameter | Unit | Configuration | Cell 2 | |
|---|---|---|---|---|
| | | | T1 | T2 |
| RF channel number | | 1, 2, 3, 4, 5, 6 | 2 | |
| Duplex mode | | 1, 2, 3 | FDD | |
| | | 4, 5, 6 | TDD | |
| TDD special subframe configuration[Note1] | | 4, 5, 6 | 6 | |
| TDD uplink-downlink configuration[Note1] | | 4, 5, 6 | 1 | |
| $BW_{channel}$ | MHz | 1, 2, 3, 4, 5, 6 | 5MHz: $N_{RB,c}$ = 25<br>10MHz: $N_{RB,c}$ = 50<br>20MHz: $N_{RB,c}$ = 100 | |
| PRACH Configuration[Note2] | | 1, 2, 3 | 4 | |
| | | 4, 5, 6 | 53 | |
| PDSCH parameters:<br>DL Reference Measurement Channel[Note3] | | 1, 2, 3 | 5MHz: R.7 FDD<br>10MHz: R.3 FDD<br>20MHz: R.6 FDD | |
| | | 4, 5, 6 | 5MHz: R.4 TDD<br>10MHz: R.0 TDD<br>20MHz: R.3 TDD | |
| PCFICH/PDCCH/PHICH parameters:<br>DL Reference Measurement Channel[Note3] | | 1, 2, 3 | 5MHz: R.11 FDD<br>10MHz: R.6 FDD<br>20MHz: R.10 FDD | |
| | | 4, 5, 6 | 5MHz: R.11 TDD<br>10MHz: R.6 TDD<br>20MHz: R.10 TDD | |
| OCNG Patterns[Note3] | | 1, 2, 3 | 5MHz: OP.20 FDD<br>10MHz: OP.10 FDD<br>20MHz: OP.17 FDD | |
| | | 4, 5, 6 | 5MHz: OP.9 TDD<br>10MHz: OP.1 TDD<br>20MHz: OP.7 TDD | |
| PBCH_RA | dB | 1, 2, 3, 4, 5, 6 | 0 | |
| PBCH_RB | | | | |
| PSS_RA | | | | |
| SSS_RA | | | | |
| PCFICH_RB | | | | |
| PHICH_RA | | | | |
| PHICH_RB | | | | |
| PDCCH_RA | | | | |
| PDCCH_RB | | | | |
| PDSCH_RA | | | | |
| PDSCH_RB | | | | |
| OCNG_RA[Note4] | | | | |
| OCNG_RB[Note4] | | | | |
| $N_{oc}$[Note5] | dBm/15kHz | 1, 2, 3, 4, 5, 6 | -98 | |
| $\hat{E}_s/N_{oc}$ | dB | 1, 2, 3, 4, 5, 6 | -Infinity | 7 |
| $\hat{E}_s/I_{ot}$[Note6] | dB | 1, 2, 3, 4, 5, 6 | -Infinity | 7 |
| RSRP[Note6] | dBm/15kHz | 1, 2, 3, 4, 5, 6 | -Infinity | -91 |
| SCH_RP[Note6] | dBm/15kHz | 1, 2, 3, 4, 5, 6 | -Infinity | -91 |
| Io[Note6] | dBm/9MHz | 1, 2, 3, 4, 5, 6 | -70.22 | -62.43 |
| Propagation Condition | | 1, 2, 3, 4, 5, 6 | AWGN | |
| Antenna Configuration and Correlation Matrix [Note7] | | 1, 2, 3, 4, 5, 6 | 1x2 Low | |

Note 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211.
Note 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211.
Note 3: DL RMCs and OCNG patterns are specified in sections A 3.1 and A 3.2 of TS 36.133 respectively.
Note 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 7: Propagation condition and correlation matrix are defined in section B.2 in TS 36.101 [25].

##### A.6.3.1.5.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 165 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and is specified in section 6.1.2.1.

$T_{interrupt}$ = 115 ms in the test; $T_{interrupt}$ is defined in section 6.1.2.1.

This gives a total of 165 ms.

## A.6.3.2 RRC Connection Mobility Control

### A.6.3.2.1 SA: RRC Re-establishment

### A.6.3.2.2 Random Access

#### A.6.3.2.2.1 Contention based random access test in FR1 for NR standalone

##### A.6.3.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.2 and Clause 7.1.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in Table A.6.3.2.2.1.1-1. UE capble of SA with PCell in FR1 needs to be tested by using the parameters in Table A.6.3.2.2.1.1-2.

**Table A.6.3.2.2.1.1-1: Supported test configurations for contention based random access test in FR1 for NR standalone**

| Config | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability | |

**Table A.6.3.2.2.1.1-1: General test parameters for contention based random access test in FR1 for NR Standalone**

| Parameter | | | Unit | Test-1 | Comments |
|---|---|---|---|---|---|
| SSB Configuration | | Config 1 | | SSB pattern 1 in FR1 | As defined in A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below |
| | | Config 2 | | SSB pattern 2 in FR1 | |
| Number of SSBs per SS-burst | | | | 2 | Different from the definition in A.3.10 |
| SS/PBCH block index | | | | 0,1 | Different from the definition in A.3.10 |
| Duplex Mode for Cell 2 | | Config 1 | | FDD | |
| | | Config 2 | | TDD | |
| TDD Configuration | | Config 2 | | TDDConf.1.2 | |
| OCNG Pattern Note 1 | | | | OCNG pattern 1 | As defined in A.3.2.1. |
| PDSCH parameters Note 4 | | Config 1 | | SR1.1 FDD | As defined in A.3.1.1. |
| | | Config 2 | | SR2.1 TDD | |
| NR RF Channel Number | | | | 1 | |
| EPRE ratio of PSS to SSS | | | dB | 0 | |
| EPRE ratio of PBCH_DMRS to SSS | | | dB | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | dB | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | dB | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | dB | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | dB | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | dB | | |
| SSB with index 0 | $\hat{E}_s/I_{ot}$ | | dB | 3 | SSB with index 0 is signalled to be above configured *rsrp-ThresholdSSB* |
| | $N_{oc}$ | Config 1 | dBm/15kHz | -98 | |
| | | Config 2 | | -101 | |
| | $\hat{E}_s/N_{oc}$ | | dB | 3 | |
| | SS-RSRP Note 3 | | dBm/ SCS | -95 | |
| SSB with index 1 | $\hat{E}_s/I_{ot}$ | | dB | -17 | SSB with index 1 is signalled to be below configured *rsrp-ThresholdSSB* |
| | $N_{oc}$ | Config 1 | dBm/15kHz | -98 | |
| | | Config 2 | | -101 | |
| | $\hat{E}_s/N_{oc}$ | | dB | -17 | |
| | SS-RSRP Note 3 | | dBm/ SCS | -115 | |
| Io Note 2 | | Config 1 | dBm | -65.3/9.36MHz | For symbols without SSB index 1 |
| | | Config 2 | | -62.2/38.16MHz | |
| ss-PBCH-BlockPower | | | dBm/ SCS | -5 | As defined in clause 6.3.2 in TS 38.331 [2]. |
| Configured UE transmitted power ( $P_{\mathrm{CMAX,\ f,c}}$ ) | | | dBm | 23 | As defined in clause 6.2.4 in TS 38.101-1. |
| PRACH Configuration | | | | FR1 PRACH configuration 1 | As defined in A.3.x. |
| Propagation Condition | | | - | AWGN | |

Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
Note 2: Io level has been derived from other parameters for information purpose. It is not a settable parameter.
Note 3: RSRP level has been derived from other parameters for information purposes. It is not a settable parameter.
Note 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

### A.6.3.2.2.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

##### A.6.3.2.2.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in Subclause 6.2.2.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

##### A.6.3.2.2.1.2.2 Random Access Response Reception

To test the UE behavior specified in Subclause 6.2.2.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

##### A.6.3.2.2.1.2.3 No Random Access Response Reception

To test the UE behavior specified in subclause 6.2.2.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

##### A.6.3.2.2.1.2.4 Receiving a NACK on msg3

To test the UE behavior specified in subclause 6.2.2.2.1.4 the System Simulator shall NACK *all* UE msg3 following a successful Random Access Response.

The UE shall re-transmit the msg3 upon the reception of a NACK on msg3 until the maximum number of HARQ re-transmissions is reached.

##### A.6.3.2.2.1.2.5 Reception of an Incorrect Message over Temporary C-RNTI

To test the UE behavior specified in Subclause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element *not* matching the CCCH SDU transmitted in msg3 uplink message.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

##### A.4.3.2.2.1.2.6 Reception of a Correct Message over Temporary C-RNTI

To test the UE behavior specified in Subclause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element matching the CCCH SDU transmitted in the msg3 uplink message.

The UE shall send ACK if the Contention Resolution is successful.

##### A.6.3.2.2.1.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in Subclause 6.2.2.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

#### A.6.3.2.2.2 Non-Contention based random access test in FR1 for NR standalone

##### A.6.3.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.2 and Clause 7.1.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in Table A.6.3.2.2.2.1-1. UE capble of SA with PCell in FR1 needs to be tested by using the parameters in Table A.6.3.2.2.2.1-2 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2).

**Table A.6.3.2.2.2.1-1: Supported test configurations for non-contention based random access test in FR1 for NR standalone**

| Config | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability | |

**Table A.6.3.2.2.2.1-2: General test parameters for non-contention based random access test in FR1 for NR Standalone**

| Parameter | | | Unit | Test-1 | Test-2 | Comments |
|---|---|---|---|---|---|---|
| SSB Configuration | Config 1 | | | SSB pattern 1 in FR1 | SSB pattern 1 in FR1 | As defined in A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below |
| | Config 2 | | | SSB pattern 2 in FR1 | SSB pattern 2 in FR1 | |
| Number of SSBs per SS-burst | | | | 2 | 2 | Different from the definition in A.3.10 |
| SS/PBCH block index | | | | 0,1 | 0,1 | Different from the definition in A.3.10 |
| CSI-RS Configuration | Config 1 | | | N/A | CSI-RS.1.1 FDD | As defined in A.3.1.4 |
| | Config 2 | | | | CSI-RS.2.1 TDD | |
| Duplex Mode for Cell 2 | Config 1 | | | FDD | FDD | |
| | Config 2 | | | TDD | TDD | |
| TDD Configuration | Config 2 | | | TDDConf.1.2 | TDDConf.1.2 | |
| OCNG Pattern Note 1 | | | | OCNG pattern 1 | OCNG pattern 1 | As defined in A.3.2.1. |
| PDSCH parameters Note 4 | Config 1 | | | SR1.1 FDD | SR1.1 FDD | As defined in A.3.1.1. |
| | Config 2 | | | SR2.1 TDD | SR2.1 TDD | |
| NR RF Channel Number | | | | 1 | 1 | |
| EPRE ratio of PSS to SSS | | | dB | 0 | 0 | |
| EPRE ratio of PBCH_DMRS to SSS | | | dB | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | dB | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | dB | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | dB | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | dB | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | dB | | | |
| SSB with index 0 | $\hat{E}_s/I_{ot}$ | | dB | 3 | 3 | SSB with index 0 is signalled to be above configured *rsrp-ThresholdSSB* |
| | $N_{oc}$ | Config 1 | dBm/15kHz | -98 | -98 | |
| | | Config 2 | | -101 | -101 | |
| | $\hat{E}_s/N_{oc}$ | | dB | 3 | 3 | |
| | SS-RSRP Note 3 | | dBm/ SCS | -95 | -95 | |
| SSB with index 1 | $\hat{E}_s/I_{ot}$ | | dB | -17 | -17 | SSB with index 1 is signalled to be below configured *rsrp-ThresholdSSB* |
| | $N_{oc}$ | Config 1 | dBm/15kHz | -98 | -98 | |
| | | Config 2 | | -101 | -101 | |
| | $\hat{E}_s/N_{oc}$ | | dB | -17 | -17 | |
| | SS-RSRP Note 3 | | dBm/ SCS | -115 | -115 | |
| Io Note 2 | Config 1 | | dBm | -65.3/9.36MHz | -65.3/9.36MHz | For symbols without SSB index 1 |
| | Config 2 | | | -62.2/38.16MHz | -62.2/38.16MHz | |
| ss-PBCH-BlockPower | | | dBm/ SCS | -5 | -5 | As defined in clause 6.3.2 in TS 38.331 [2]. |
| Configured UE transmitted power ( $P_{\text{CMAX, f,c}}$ ) | | | dBm | 23 | 23 | As defined in clause 6.2.4 in TS 38.101-1. |
| PRACH Configuration | | | | FR1 PRACH configuration 2 | FR1 PRACH configuration 3 | As defined in A.3.8.2.. |
| Propagation Condition | | | - | AWGN | AWGN | |

Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
Note 2: Io level has been derived from other parameters for information purpose. It is not a settable parameter.
Note 3: RSRP level has been derived from other parameters for information purposes. It is not a settable parameter.
Note 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

###### A.6.3.2.2.2.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

###### A.6.3.2.2.2.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in Subclause 6.2.2.2.2.1 for SSB-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.6.3.2.2.2.2.2 CSI-RS-based Random Access Preamble Transmission

In Test-2, to test the UE behavior specified in Subclause 6.2.2.2.2.1 for CSI-RS-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the CSI-RS configured.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-OccasionList*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.6.3.2.2.2.2.3 Random Access Response Reception

To test the UE behavior specified in Subclause 6.2.2.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.6.3.2.2.2.2.4 No Random Access Response Reception

To test the UE behavior specified in subclause 6.2.2.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

#### A.6.3.2.3 SA: RRC Connection Release with Redirection

## A.6.4 Timing

### A.6.4.1 UE transmit timing

#### A.6.4.1.1 NR UE Transmit Timing Test for FR1

##### A.6.4.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in Table 6.4.1.1.1-1

**Table A.6.4.1.1.1-1: Supported test configurations for FR1 PCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR SCS 15 kHz, BW 10 MHz, FDD |
| 2 | LTE FDD, NR SCS 15 kHz, BW 10 MHz, TDD |
| 3 | LTE FDD, NR SCS 30 kHz, BW 40 MHz, TDD |
| 4 | LTE FDD, NR SCS 15 kHz, BW 10 MHz, FDD |
| 5 | LTE FDD, NR SCS 15 kHz, BW 10 MHz, TDD |
| 6 | LTE FDD, NR SCS 30 kHz, BW 40 MHz, TDD |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

For this test a single NR cell is used. Table A.6.4.1.1.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in Table A.6.4.1.1.1-3.

**Table A.6.4.1.1.1-2: Cell Specific Test Parameters for UL Transmit Timing test**

| Parameter | | Unit | Config | Test1 | Test2 |
|---|---|---|---|---|---|
| E-UTRA Channel Number | | | 1,2,3,4,5,6 | 1 | 1 |
| NR Channel Number | | | 1,2,3,4,5,6 | 2 | 2 |
| TDD configuration | | | 1,4 | Not Applicable | |
| | | | 2,5 | TDDConf.1.1 | |
| | | | 3,6 | TDDConf.1.2 | |
| $BW_{channel}$ | | MHz | 1,4 | 10: NRB,c = 52 | |
| | | | 2,5 | 10: $N_{RB,c}$ = 52 | |
| | | | 3,6 | 40: $N_{RB,c}$ = 106 | |
| BWP | DL BWP | | 1,2,3,4,5,6 | DLBWP.1.1 | |
| | UL BWP | | 1,2,3,4,5,6 | ULBWP.1.1 | |
| DRx Cycle | | ms | 1,2,3,4,5,6 | N/A | 320[Note5] |
| PDSCH Reference measurement channel | | | 1,4 | SR.1.1 FDD | |
| | | | 2,5 | SR.1.1 TDD | |
| | | | 3,6 | SR.2.1 TDD | |
| RMSI CORESET Reference Channel | | | 1,4 | CR.1.1 FDD | |
| | | | 2,5 | CR.1.1 TDD | |
| | | | 3,6 | CR.2.1 TDD | |
| Dedicated CORESET Reference Channel | | | 1,4 | CCR.1.1 FDD | |
| | | | 2,5 | CCR.1.1 TDD | |
| | | | 3,6 | CCR.2.1 TDD | |
| OCNG Patterns | | | 1,2,3,4,5,6 | OP.1 | |
| SSB configuration | | | 1,2,4,5 | SSB.1 FR1 | |
| | | | 3,6 | SSB.2 FR1 | |
| SMTC configuration | | | 1,2,4,5 | SMTC.1 | |
| | | | 3,6 | SMTC.1 | |
| EPRE ratio of PSS to SSS | | dB | 1,2,3,4,5,6 | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | |
| $N_{oc}$ Note2 | | dBm/15 kHz | 1,2,3,4,5,6 | -98 | -98 |
| $N_{oc}$ Note2 | | dBm/SCS | 1,2,4,5 | -98 | -98 |
| | | | 3,6 | -95 | -95 |
| $\hat{E}_s/I_{ot}$ | | | 1,2,3,4,5,6 | 3 | 3 |
| $\hat{E}_s/N_{oc}$ | | | 1,2,3,4,5,6 | 3 | 3 |
| SS-RSRP[Note3] | | dBm/SCS | 1,2,4,5 | -95 | -95 |
| | | | 3,6 | -92 | -92 |
| Io[Note3] | | dBm/9.36MHz | 1,2,4,5 | -65.2 | -65.2 |
| | | dBm/38.1MHz | 3,6 | -59.2 | -59.2 |
| Propagation condition | | | 1,2,3,4,5,6 | AWGN | |
| SRS Config | | | 1,2,3,4,5,6 | Config1[Note6] | Config2[Note6] |

**Table A.6.4.1.1.1-3: SRS Configuration for Timing Accuracy Test**

| | Field | Config1 | Config 2 | Comments |
|---|---|---|---|---|
| SRS-ResourceSet | srs-ResourceSetId | 0 | 0 | |
| | srs-ResourceIdList | 0 | 0 | |
| | resourceType | Periodic | Periodic | |
| | Usage | Codebook | Codebook | |
| | SRS-ResourceSetId | 0 | 0 | |
| SRS-Resource | nrofSRS-Ports | Port1 | Port1 | |
| | transmissionComb | n2 | n2 | |
| | combOffset-n2 | 0 | 0 | |
| | cyclicShift-n2 | 0 | 0 | |
| | resourceMapping startPosition | 0 | 0 | |
| | resourceMapping nrofSymbols | n1 | n1 | |
| | resourceMapping repetitionFactor | n1 | n1 | |
| | freqDomainPosition | 0 | 0 | |
| | freqDomainShift | 0 | 0 | |
| | freqHopping c-SRS | sl1 | sl1 | |
| | freqHopping b-SRS | 0 | 0 | |
| | freqHopping b-hop | 0 | 0 | |
| | groupOrSequenceHopping | Neither | Neither | |
| | resourceType | Periodic | Periodic | |
| | periodicityAndOffset-p | sl1 | sl640 | Offset to align with DRx periodicity |
| | sequenceId | 0 | 0 | Any 10 bit number |

**Table A.6.4.1.1.1-4: DRX-Configuration for UL Timing Tests.**

| Field | Test 2 |
|---|---|
| | Value |
| drx-onDurationTimer | [ms6] |
| drx-InactivityTimer | [ms1] |
| drx-RetransmissionTimerDL | [sl1] |
| drx-RetransmissionTimerUL | [sl1] |
| longDRX-CycleStartOffset | [ms320] |
| shortDRX | disable |

## A.6.4.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Setup NR PCell according to parameters given in Table A.6.4.1.1.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within ($N_{TA}$ + $N_{TA\_offset}$) ± $T_e$ of the first detected path of DL SSB.

   a. The $N_{TA}$ offset value (in $T_c$ units) is 25600 for FR1 and 13792 for FR2

   b. The $T_e$ values depend on the DL and UL SCS for which the test is being run and are given in Table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in Table A.6.4.1.1.2-1

**Table A.6.4.1.1.2-1: Adjustment Value for DL Timing**

| SCS of SSB signals (KHz) | Adjustment Value | |
|---|---|---|
| | Test1 | Test2 |
| 15 | +64*64$T_c$ | +32*64$T_c$ |
| 30 | +32*64$T_c$ | +16*64$T_c$ |
| 120 | +16*64$T_c$ | +8*64$T_c$ |
| 240 | +8*64$T_c$ | +4*64$T_c$ |

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in Section 7.1.2 Table 7.1.2-3. This will only be done for Test1.

5) The test system shall verify that the UE transmit timing offset stays within ($N_{TA}$ + $N_{TA\_offset}$) ± $T_e$ of the first detected path of DL SSB. For Test 2 and Test 4 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment

# A.6.4.2 UE timer accuracy

# A.6.4.3 Timing advance

## A.6.4.3.1 SA FR1 timing advance adjustment accuracy

### A.6.4.3.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

### A.6.4.3.1.2 Test Parameters

Supported test configurations are shown in table A.6.4.3.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.6.4.3.1.2-2, A.6.4.3.1.2-3 and A.6.4.3.1.2-4.

In all test cases, single cell is used. Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.6.4.3.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, as specified in Clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to Clause 4.2 in TS 38.213 results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value specified in table A.6.4.3.1.2-2. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in Clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in Clause 5.2 in TS 38.321, shall be configured so that it does not expire in the duration of the test.

**Table A.6.4.3.1.2-1: Timing advance supported test configurations**

| Config | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.6.4.3.1.2-2: General test parameters for timing advance**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF channel number | | 1 | |
| DL BWP | | DLBWP.1.1 | As specified in Table A.3.9.2.1-1 |
| UL BWP | | ULBWP.1.1 | As specified in Table A.3.9.2.2-1 |
| TRS | | TBD | TBD |
| Timing Advance Command ($T_A$) value during T1 | | 31 | $N_{TA\_new} = N_{TA\_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2 |
| Timing Advance Command ($T_A$) value during T2 | | 39 | $N_{TA\_new} = N_{TA\_old} + 8192*T_c$ (based on equation in TS 38.213 [3] section 4.2) |
| T1 | s | 5 | |
| T2 | s | 5 | |

**Table A.6.4.3.1.2-3: Cell specific test parameters for timing advance**

| Parameter | Unit | Test1 | |
|---|---|---|---|
| | | T1 | T2 |

| | | | |
|---|---|---|---|
| Duplex mode | Config 1 | | FDD |
| | Config 2,3 | | TDD |
| TDD configuration | Config 1 | | Not Applicable |
| | Config 2 | | TDDConf.1.1 |
| | Config 3 | | TDDConf.2.1 |
| $BW_{channel}$ | Config 1 | MHz | 10: $N_{RB,c}$ = 52 |
| | Config 2 | | 10: $N_{RB,c}$ = 52 |
| | Config 3 | | 40: $N_{RB,c}$ = 106 |
| BWP BW | Config 1 | MHz | 10: $N_{RB,c}$ = 52 |
| | Config 2 | | 10: $N_{RB,c}$ = 52 |
| | Config 3 | | 40: $N_{RB,c}$ = 106 |
| DRx Cycle | | ms | Not Applicable |
| PDSCH Reference measurement channel | Config 1 | | SR.1.1 FDD |
| | Config 2 | | SR.1.1 TDD |
| | Config 3 | | SR2.1 TDD |
| CORESET Reference Channel | Config 1 | | CR.1.1 FDD |
| | Config 2 | | CR.1.1 TDD |
| | Config 3 | | CR2.1 TDD |
| OCNG Patterns | | | OCNG pattern 1 |
| SMTC configuration | Config 1,2 | | SMTC.1 FR1 |
| | Config 3 | | SMTC.2 FR1 |
| PDSCH/PDCCH subcarrier spacing | Config 1,2 | kHz | 15 kHz |
| | Config 3 | | 30 kHz |
| PUCCH/PUSCH subcarrier spacing | Config 1,2 | kHz | 15 kHz |
| | Config 3 | | 30 kHz |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | |
| EPRE ratio of PDSCH to PDSCH | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| $N_{oc}$ Note2 | | dBm/15kHz | -98 |
| $N_{oc}$ Note2 | Config 1,2 | dBm/SCS | -98 |
| | Config 3 | | -95 |
| $\hat{E}_s/I_{ot}$ | | dB | 3 |
| $\hat{E}_s/N_{oc}$ | | dB | 3 |
| Io Note3 | Config 1,2 | dBm/ 9.36MHz | -67.57 |
| | Config 3 | dBm/ 38.16MHz | -62.58 |
| Propagation condition | | - | AWGN |

| | |
|---|---|
| Note 1: | OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. |
| Note 2: | Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. |
| Note 3: | Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |

**Table A.6.4.3.1.2-4: Sounding Reference Symbol Configuration for timing advance**

| Field | | Value | Comment |
|---|---|---|---|
| c-SRS | Config 1,2 | 12 | Frequency hopping is disabled |
| | Config 3 | 24 | |
| b-SRS | | 0 | |
| b-hop | | 0 | |
| freqDomainPosition | | 0 | Frequency domain position of SRS |
| freqDomainShift | | 0 | |
| groupOrSequenceHopping | | neither | No group or sequence hopping |
| SRS-PeriodicityAndOffset | | sl5=0 | Once every 5 slots |
| pathlossReferenceRS | | ssb-Index=0 | SSB #0 is used for SRS path loss estimation |
| usage | | nonCodebook | Non-codebook based UL transmission |
| startPosition | | 0 | resourceMapping setting. SRS on last symbol of slot, and 1symbols for SRS without repetition. |
| nrofSymbols | | n1 | |
| repetitionFactor | | n1 | |
| combOffset-n2 | | 0 | transmissionComb setting |
| cyclicShift-n2 | | 0 | |
| nrofSRS-Ports | | port1 | Number of antenna ports used for SRS transmission |
| Note: For further information see clause 6.3.2 in TS 38.331 [2]. | | | |

#### A.6.4.3.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value to the transmission timing at the designated activation time i.e. *k* slots after the reception of the timing advance command, where:

$k$ = 4 for Config 1, 2, and

$k$ = 7 for Config 3

The Timing Advance adjustment accuracy shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90%.

## A.6.5 Signaling characteristics

### A.6.5.1 Radio link Monitoring

In the following section, any uplink signal transmitted by the UE is used for detecting the In-/Out-of-Sync state of the UE. In terms of measurement, the uplink signal is verified on the basis of the UE output power:

For intra-band contiguous carrier aggregation, transmit OFF power is measured as the mean power per component carrier.

For UE with multiple transmit antennas, transmit OFF power is measured as the mean power at each transmit connector.

- UE output power higher than Transmit OFF power [-50] dBm (as defined in TS 38.101-1 [TBD]) means uplink signal
- UE output power equal to or less than Transmit OFF power [-50] dBm (as defined in TS 38.101-1 [TBD]) means no uplink signal.

#### A.6.5.1.1 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with SSB-based RLM RS in non-DRX mode

##### A.6.5.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

Supported test configurations are shown in table A.6.5.1.1.1-1. The test parameters are given in Tables A.6.5.1.1.1-2, A.6.5.1.1.1-3, and A.6.5.1.1.1-4 below. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.6.5.1.1.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms) in test 2.

*Editor note: whether to revise power level to be gradually changed*

*Editor note: whether to revise the SSB configuration to be 2 SSBs and FFS the corresponding power level*

**Table A.6.5.1.1.1-1: Supported test configurations for FR1 PCell**

| Configuration | Description |
|---|---|
| 1 | FDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 2 | TDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 3 | TDD, SSB SCS 30 KHz, data SCS 30KHz, BW 40MHz |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.6.5.1.1.1-2: General test parameters for FR1 out-of-sync testing in non-DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 1 | Test 2 |
| Active PCell | | | Cell 1 | Cell 1 |
| RF Channel Number | | | 1 | 1 |
| Duplex mode | Config 1 | | FDD | FDD |
| | Config 2, 3 | | TDD | TDD |
| TDD Configuration | Config 1 | | Not Applicable | Not Applicable |
| | Config 2 | | [TDDConf.1.1] | [TDDConf.1.1] |
| | Config 3 | | [TDDConf.1.2] | [TDDConf.1.2] |
| CORESET Reference Channel | Config 1 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] |
| | Config 2 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] |
| | Config 3 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] |
| SSB Configuration | Config 1 | | Table A.3.2.2.1.1-1 | Table A.3.2.2.1.1-1 |
| | Config 2 | | Table A.3.2.2.1.1-1 | Table A.3.2.2.1.1-1 |
| | Config 3 | | Table A.3.2.2.1.2-1 | Table A.3.2.2.1.2-1 |
| SMTC Configuration | Config 1, 2 | | Table A.3.2.3.1-1 | Table A.3.2.3.1-1 |
| | Config 3 | | Table A.3.2.3.1-1 | Table A.3.2.3.1-1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 | | 15 KHz | 15 KHz |
| | Config 3 | | 30 KHz | 30 KHz |
| PRACH Configuration | Config 1, 2 | | TBD | TBD |
| | Config 3 | | TBD | TBD |
| SSB index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | Table A.3.2.1.1-1 | Table A.3.2.1.1-1 |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *OFF* | *OFF* |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | TBD | TBD |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1, 2 | slot | [5] | [5] |
| | Config 3 | | [10] | [10] |
| T1 | | s | 1 | 1 |

| | | | |
|---|---|---|---|
| T2 | s | 0.4 | 0.4 |
| T3 | s | [0.6] | [0.6] |
| D1 | s | [0.24] | [0.44] |
| Note 1: All configurations are assigned to the UE prior to the start of time period T1.<br>Note 2: UE-specific PDCCH is not transmitted after T1 starts. | | | |

**Table A.6.5.1.1.1-3: Cell specific test parameters for FR1 (Cell 1) for out-of-sync radio link monitoring tests in non-DRX mode**

| Parameter | | Unit | Test 1 | | | Test 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1 | dB | [1] | [-7] | [-15] | [1] | [-7] | [-15] |
| | Config 2 | | [1]TBD | [-7] | [-15] | [1] | [-7] | [-15] |
| | Config 3 | | [1]TBD | [-7] | [-15] | [1] | [-7] | [-15] |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | [-98] | | |
| | Config 2 | | [-98] | | | [-98] | | |
| | Config 3 | | [-98] | | | [-98] | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | [TDL-C 300ns 100Hz] | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.6.5.1.1.1-1.<br>Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6]. | | | | | | | | |

**Table A.6.5.1.1.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |
| Note: Ensure that RLM RS is partially overlapped with measurement gap | |

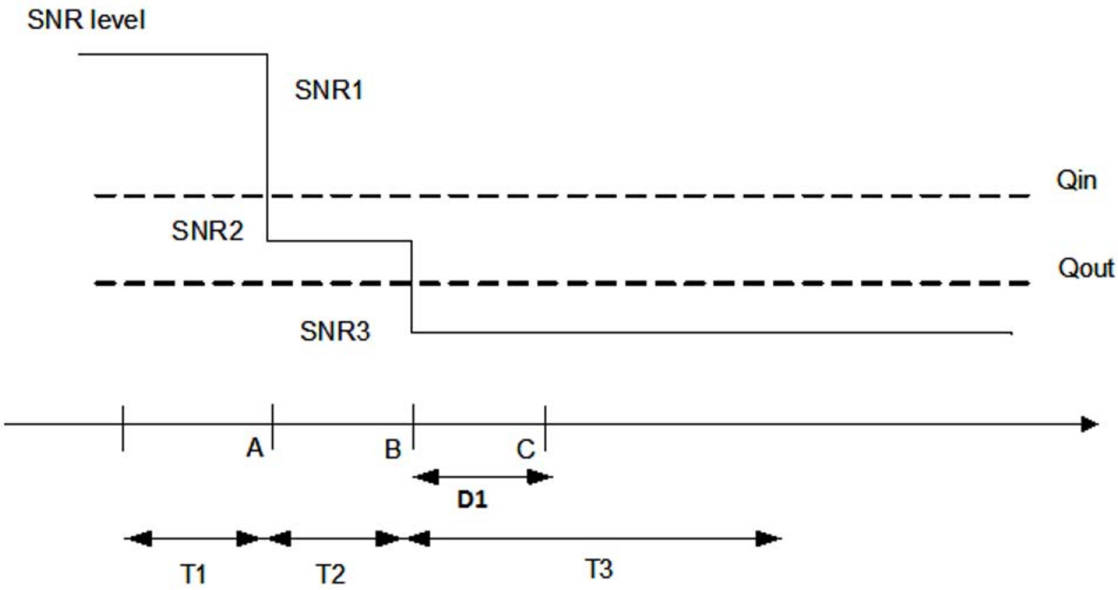


**Figure A.6.5.1.1.1-1: SNR variation for out-of-sync testing**

##### A.6.5.1.1.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

#### A.6.5.1.2 Radio Link Monitoring In-sync Test for FR1 PCell configured with SSB-based RLM RS in non-DRX mode

##### A.6.5.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

Supported test configurations are shown in table A.6.5.1.2.1-1. The test parameters are given in Tables A.6.5.1.2.1-2, A.6.5.1.2.1-3, and A.6.5.1.2.1-4 below. There is one cell (Cell 1), which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.1.2.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms) in test 2.

*Editor note: whether to revise power level to be gradually changed*

*Editor note: whether to revise the SSB configuration to be 2 SSBs and FFS the corresponding power level*

**Table A.6.5.1.2.1-1: Supported test configurations for FR1 PCell**

| Configuration | Description |
|---|---|
| 1 | FDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 2 | TDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 3 | TDD, SSB SCS 30 KHz, data SCS 30KHz, BW 40MHz |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.6.5.1.2.1-2: General test parameters for FR1 in-sync testing in non-DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 1 | Test 2 |
| Active PCell | | | Cell 1 | Cell 1 |
| RF Channel Number | | | 1 | 1 |
| Duplex mode | Config 1 | | FDD | FDD |
| | Config 2, 3 | | TDD | TDD |
| TDD Configuration | Config 1 | | Not Applicable | Not Applicable |
| | Config 2 | | [TDDConf.1.1] | [TDDConf.1.1] |
| | Config 3 | | [TDDConf.1.2] | [TDDConf.1.2] |
| CORESET Reference Channel | Config 1 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] |
| | Config 2 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] |
| | Config 3 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] |
| SSB Configuration | Config 1 | | Table A.3.2.2.1.1-1 | Table A.3.2.2.1.1-1 |
| | Config 2 | | Table A.3.2.2.1.1-1 | Table A.3.2.2.1.1-1 |
| | Config 3 | | Table A.3.2.2.1.2-1 | Table A.3.2.2.1.2-1 |
| SMTC Configuration | Config 1, 2 | | Table A.3.2.3.1-1 | Table A.3.2.3.1-1 |
| | Config 3 | | Table A.3.2.3.1-1 | Table A.3.2.3.1-1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 | | 15 KHz | 15 KHz |
| | Config 3 | | 30 KHz | 30 KHz |
| PRACH Configuration | Config 1, 2 | | TBD | TBD |
| | Config 3 | | TBD | TBD |
| SSB index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | Table A.3.2.1.1-1 | Table A.3.2.1.1-1 |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| In sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 4 | 4 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 0 | 0 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 0 | 0 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *OFF* | *OFF* |
| Gap pattern ID | | | [N.A.] | *[*gp0*]* |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | 2000 | 2000 |

| | | | | |
|---|---|---|---|---|
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | TBD | TBD |
| ZP CSI-RS configuration | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1, 2 | slot | [5] | [5] |
| | Config 3 | | [10] | [10] |
| T1 | | s | 0.5 | 0.5 |
| T2 | | s | 0.4 | 0.4 |
| T3 | | s | [1.46] | [1.36] |
| T4 | | s | 0.4 | 0.4 |
| T5 | | s | [1] | [1] |
| D1 | | s | [0.42] | [0.72] |
| Note 1: All configurations are assigned to the UE prior to the start of time period T1.<br>Note 2: UE-specific PDCCH is not transmitted after T1 starts. | | | | |

**Table A.6.5.1.2.1-3: Cell specific test parameters for FR1 (Cell 1) for in-sync radio link monitoring tests in non-DRX mode**

| Parameter | | Unit | Test 1 | | | | | Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| PDCCH_beta | | dB | 4 | | | | | 4 | | | | |
| PDCCH_DMRS_beta | | dB | 4 | | | | | 4 | | | | |
| PBCH_beta | | dB | 0 | | | | | 0 | | | | |
| PSS_beta | | dB | | | | | | | | | | |
| SSS_beta | | dB | | | | | | | | | | |
| PDSCH_beta | | dB | | | | | | | | | | |
| OCNG_beta | | dB | | | | | | | | | | |
| SNR | Config 1 | dB | [1] | [-7] | [-15] | [-4.5] | [1] | [1] | [-7] | [-15] | [-4.5] | [1] |
| | Config 2 | | [1] | [-7] | [-15] | [-4.5] | [1] | [1] | [-7] | [-15] | [-4.5] | [1] |
| | Config 3 | | [1] | [-7] | [-15] | [-4.5] | [1] | [1] | [-7] | [-15] | [-4.5] | [1] |
| $N_{oc}$ | Config 1 | dBm/15 kHz | [-98] | | | | | [-98] | | | | |
| | Config 2 | | [-98] | | | | | [-98] | | | | |
| | Config 3 | | [-98] | | | | | [-98] | | | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | | | [TDL-C 300ns 100Hz] | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.6.5.1.2.1-1.<br>Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in section [A.3.6]. | | | | | | | | | | | | |

**Table A.6.5.1.2.1-4: Measurement gap configuration for in-sync tests in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [TBD] |
| Note 1: Ensure that RLM RS is partially overlapped with measurement gap | |

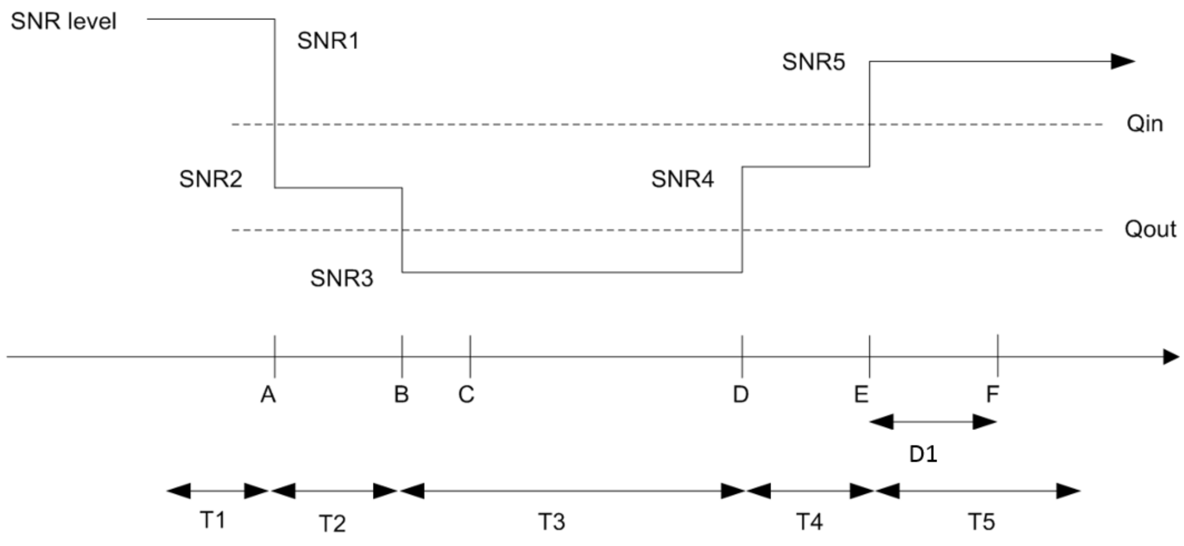


**Figure A.6.5.1.2.1-1: SNR variation for in-sync testing**

#### A.6.5.1.2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

### A.6.5.1.3 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with SSB-based RLM RS in DRX mode

#### A.6.5.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

Supported test configurations are shown in table A.6.5.1.3.1-1. The test parameters are given in Tables A.6.5.1.3.1-2, A.6.5.1.3.1-3, A.6.5.1.3.1-4, A.6.5.1.3.1-5, and A.6.5.1.3.1-6. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.6.5.1.3.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms) in test 2.

*Editor note: whether to revise power level to be gradually changed*

*Editor note: whether to revise the SSB configuration to be 2 SSBs and FFS the corresponding power level*

**Table A.6.5.1.3.1-1: Supported test configurations for FR1 PCell**

| Configuration | Description |
|---|---|
| 1 | FDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 2 | TDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 3 | TDD, SSB SCS 30 KHz, data SCS 30KHz, BW 40MHz |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.6.5.1.3.1-2: General test parameters for FR1 out-of-sync testing in DRX mode**

| Parameter | | Unit | Value Test 1 |
|---|---|---|---|
| Active PCell | | | Cell 1 |
| RF Channel Number | | | 1 |
| Duplex mode | Config 1 | | FDD |
| | Config 2, 3 | | TDD |
| TDD Configuration | Config 1 | | Not Applicable |
| | Config 2 | | [TDDConf.1.1] |
| | Config 3 | | [TDDConf.1.2] |
| CORESET Reference Channel | Config 1 | | [CR. 1.1 FDD] |
| | Config 2 | | [CR. 1.1 TDD] |
| | Config 3 | | [CR. 2.1 TDD] |
| SSB Configuration | Config 1 | | Table A.3.2.2.1.1-1 |
| | Config 2 | | Table A.3.2.2.1.1-1 |
| | Config 3 | | Table A.3.2.2.1.2-1 |
| SMTC Configuration | Config 1, 2 | | Table A.3.2.3.1-1 |
| | Config 3 | | Table A.3.2.3.1-1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 | | 15 KHz |
| | Config 3 | | 30 KHz |
| PRACH Configuration | Config 1, 2 | | TBD |
| | Config 3 | | TBD |
| SSB index assigned as RLM RS | | | [0] |
| OCNG parameters | | | Table A.3.2.1.1-1 |
| CP length | | | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 |
| | Number of Control OFDM symbols | | 2 |
| | Aggregation level | CCE | 8 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 4 |
| | DMRS precoder granularity | | REG bundle size |
| | REG bundle size | | 6 |
| DRX cycle | | ms | 640 |
| Gap pattern ID | | | [N.A.] |
| Layer 3 filtering | | | *Enabled* |
| T310 timer | | ms | *0* |
| T311 timer | | ms | 1000 |
| N310 | | | 1 |
| N311 | | | 1 |
| NZP CSI-RS configuration | | | TBD |
| ZP CSI-RS configuration | | | TBD |
| CSI-IM configuration | | | TBD |
| Periodic CSI reporting | | | PUCCH |
| CSI reporting periodicity | Config 1, 2 | slot | [5] |
| | Config 3 | | [10] |
| T1 | | s | 1 |
| T2 | | s | 0.4 |
| T3 | | s | [7] |
| D1 | | s | [6.44] |
| Note 1: All configurations are assigned to the UE prior to the start of time period T1.<br>Note 2: UE-specific PDCCH is not transmitted after T1 starts. | | | |

**Table A.6.5.1.3.1-3: Cell specific test parameters for FR1 (Cell 1) for out-of-sync radio link monitoring tests in DRX mode.**

| Parameter | | Unit | Test 1 | | |
|---|---|---|---|---|---|
| | | | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | |
| PBCH_beta | | dB | 0 | | |
| PSS_beta | | dB | | | |
| SSS_beta | | dB | | | |
| PDSCH_beta | | dB | | | |
| OCNG_beta | | dB | | | |
| SNR | Config 1 | dB | [1] | [-7] | [-15] |
| | Config 2 | | [1] | [-7] | [-15] |
| | Config 3 | | [1] | [-7] | [-15] |
| $N_{oc}$ | Config 1 | dBm/15 KHz | [-98] | | |
| | Config 2 | | [-98] | | |
| | Config 3 | | [-98] | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.6.5.1.3.1-1.
Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.6.5.1.3.1-5: DRX-Configuration for out-of-sync tests.**

| Field | Test 1 |
|---|---|
| | Value |
| drx-onDurationTimer | [ms6] |
| drx-InactivityTimer | [ms1] |
| drx-RetransmissionTimerDL | [sl1] |
| drx-RetransmissionTimerUL | [sl1] |
| longDRX-CycleStartOffset | [ms640] |
| shortDRX | disable |

**Table A.6.5.1.3.1-6: DRX-Configuration for out-of-sync tests.**

| Field | | Test 1 |
|---|---|---|
| | | Value |
| TimeAlignmentTimer | | infinity |
| periodicityAndOffset in SchedulingRequestResourceConfig | Config 1, 2 | [sl5] |
| | Config 3 | [sl10] |

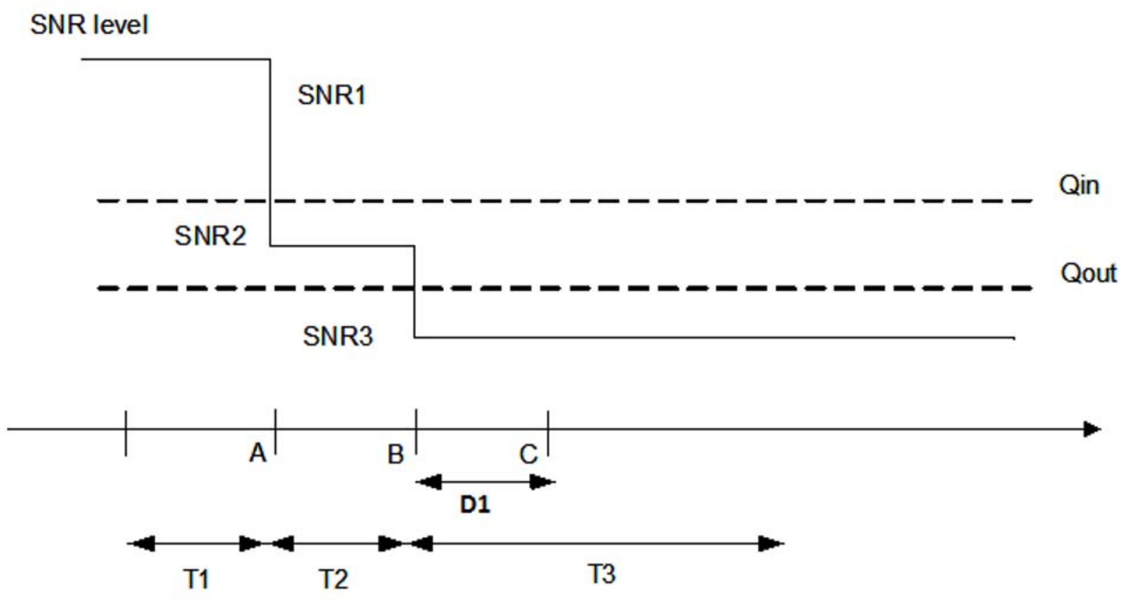


**Figure A.6.5.1.3.1-1: SNR variation for out-of-sync testing**

#### A.6.5.1.3.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

### A.6.5.1.4 Radio Link Monitoring In-sync Test for FR1 PCell configured with SSB-based RLM RS in DRX mode

#### A.6.5.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

Supported test configurations are shown in table A.6.5.1.4.1-1. The test parameters are given in Tables A.6.5.1.4.1-2, A.6.5.1.4.1-3, A.6.5.1.4.1-4, and A.6.5.1.4.1-5. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.1.4.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

*Editor note: whether to revise power level to be gradually changed*

*Editor note: whether to revise the SSB configuration to be 2 SSBs and FFS the corresponding power level*

**Table A.6.5.1.4.1-1: Supported test configurations for FR1 PCell**

| Configuration | Description |
|---|---|
| 1 | FDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 2 | TDD, SSB SCS 15 KHz, data SCS 15KHz, BW 10MHz |
| 3 | TDD, SSB SCS 30 KHz, data SCS 30KHz, BW 40MHz |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.6.5.1.4.1-2: General test parameters for FR1 in-sync testing in DRX mode**

| Parameter | | Unit | Value<br>Test 1 |
|---|---|---|---|
| Active PCell | | | Cell 1 |
| RF Channel Number | | | 1 |
| Duplex mode | Config 1 | | FDD |
| | Config 2, 3 | | TDD |
| TDD Configuration | Config 1 | | Not Applicable |
| | Config 2 | | [TDDConf.1.1] |
| | Config 3 | | [TDDConf.1.2] |
| CORESET Reference Channel | Config 1 | | [CR. 1.1 FDD] |
| | Config 2 | | [CR. 1.1 TDD] |
| | Config 3 | | [CR. 2.1 TDD] |
| SSB Configuration | Config 1 | | Table A.3.2.2.1.1-1 |
| | Config 2 | | Table A.3.2.2.1.1-1 |
| | Config 3 | | Table A.3.2.2.1.2-1 |
| SMTC Configuration | Config 1, 2 | | Table A.3.2.3.1-1 |
| | Config 3 | | Table A.3.2.3.1-1 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 | | 15 KHz |
| | Config 3 | | 30 KHz |
| PRACH Configuration | Config 1, 2 | | TBD |
| | Config 3 | | TBD |
| SSB index assigned as RLM RS | | | [0] |
| OCNG parameters | | | Table A.3.2.1.1-1 |
| CP length | | | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] |
| | | | |
| In sync transmission parameters (Note 1) | DCI format | | 1-0 |
| | Number of Control OFDM symbols | | 2 |
| | Aggregation level | CCE | 4 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 0 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 0 |
| | DMRS precoder granularity | | REG bundle size |
| | REG bundle size | | 6 |
| Out of sync transmission parameters (Note 1) | DCI format | | 1-0 |
| | Number of Control OFDM symbols | | 2 |
| | Aggregation level | CCE | 8 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 4 |
| | DMRS precoder granularity | | REG bundle size |
| | REG bundle size | | 6 |
| DRX cycle | | ms | 40 |
| Gap pattern ID | | | [N.A.] |
| Layer 3 filtering | | | *Enabled* |
| T310 timer | | ms | 2000 |
| T311 timer | | ms | 1000 |
| N310 | | | 1 |

| | | | |
|---|---|---|---|
| N311 | | | 1 |
| NZP CSI-RS configuration | | | TBD |
| ZP CSI-RS Configuration | | | TBD |
| CSI-IM configuration | | | TBD |
| Periodic CSI reporting | | | PUCCH |
| CSI reporting periodicity | Config 1, 2 | slot | [5] |
| | Config 3 | | [10] |
| T1 | | s | 4 |
| T2 | | s | 1.6 |
| T3 | | s | [1.36] |
| T4 | | s | 0.4 |
| T5 | | s | 0.4 |
| D1 | | s | [1] |
| Note 1: All configurations are assigned to the UE prior to the start of time period T1.<br>Note 2: UE-specific PDCCH is not transmitted after T1 starts. | | | |

**Table A.6.5.1.4.1-3: Cell specific test parameters for FR1 (Cell 1) for in-sync radio link monitoring tests in DRX mode**

| Parameter | | Unit | Test 1 | | | | |
|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T4 | T5 |
| PDCCH_beta | | dB | 4 | | | | |
| PDCCH_DMRS_beta | | dB | 4 | | | | |
| PBCH_beta | | dB | 0 | | | | |
| PSS_beta | | dB | | | | | |
| SSS_beta | | dB | | | | | |
| PDSCH_beta | | dB | | | | | |
| OCNG_beta | | dB | | | | | |
| SNR | Config 1, 4 | dB | [1] | [-7] | [-15] | [-4.5] | [1] |
| | Config 2, 5 | | [1] | [-7] | [-15] | [-4.5] | [1] |
| | Config 3, 6 | | [1] | [-7] | [-15] | [-4.5] | [1] |
| $N_{oc}$ | Config 1, 4 | dBm/15 kHz | [-98] | | | | |
| | Config 2, 5 | | [-98] | | | | |
| | Config 3, 6 | | [-98] | | | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.6.5.1.4.1-1.<br>Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in section [A.3.6]. | | | | | | | |

**Table A.6.5.1.4.1-4: DRX-Configuration for in-sync tests**

| Field | Test 1 Value |
|---|---|
| drx-onDurationTimer | [ms6] |
| drx-InactivityTimer | [ms1] |
| drx-RetransmissionTimerDL | [sl1] |
| drx-RetransmissionTimerUL | [sl1] |
| longDRX-CycleStartOffset | [ms40] |
| shortDRX | disable |

**Table A.6.5.1.4.1-5: TimeAlignmentTimer -Configuration for in-sync testing**

| Field | | Test 1 Value |
|---|---|---|
| TimeAlignmentTimer | | infinity |
| periodicityAndOffset in SchedulingRequestResourceConfig | Config 1, 2 | [sl5] |
| | Config 3 | [sl10] |

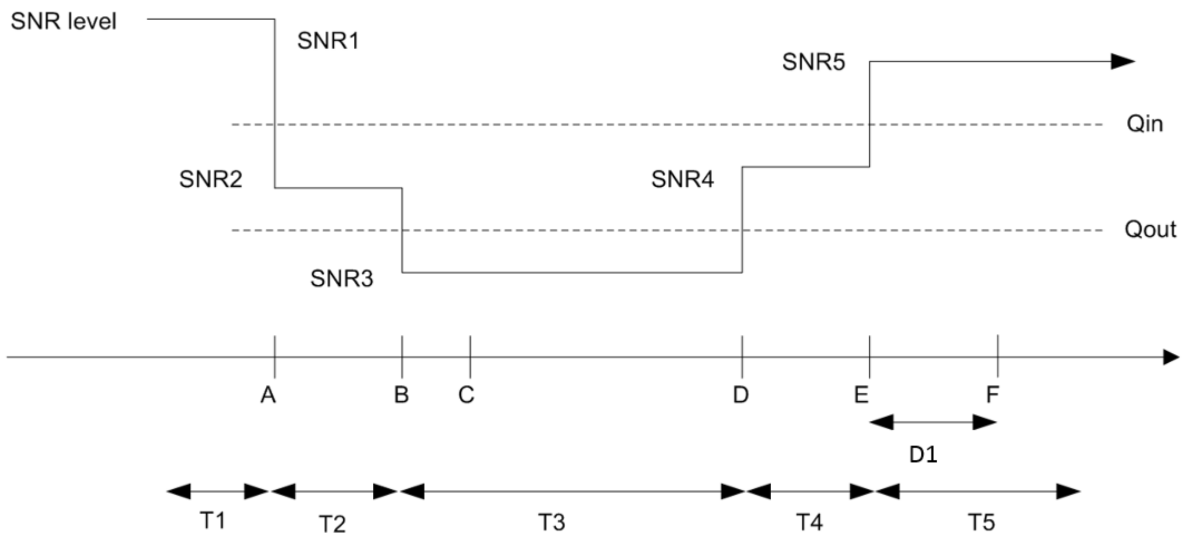


**Figure A.6.5.1.4.1-1: SNR variation for in-sync testing.**

### A.6.5.1.4.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

### A.6.5.1.5 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM in non-DRX mode

#### A.6.5.1.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.6.5.1.5.1-1, A.6.5.1.5.1-2, and A.6.5.1.5.1-3 below. There is one cell, cell 1 which is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.6.5.1.5.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] or [10] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test2.

**Table A.6.5.1.5.1-1: Supported test configurations for FR1 PCell**

| Configuration | Description |
|---|---|
| 1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 3 | TDD duplex mode, 30kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.6.5.1.5.1-2: General test parameters for FR1 PCell for CSI-RS out-of-sync testing in non-DRX mode**

| Parameter | | Unit | Value Test 1 | Test 2 |
|---|---|---|---|---|
| Active PCell | | | Cell 1 | Cell 1 |
| RF Channel Number | | | 1 | 1 |
| Duplex mode | Config 1 | | FDD | FDD |
| | Config 2, 3 | | TDD | TDD |
| TDD Configuration | Config 1 | | Not Applicable | Not Applicable |
| | Config 2 | | [TDDConf.1.1] | [TDDConf.1.1] |
| | Config 3 | | [TDDConf.1.2] | [TDDConf.1.2] |
| CORESET Reference Channel | Config 1 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] |
| | Config 2 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] |
| | Config 3 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 2 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 3 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| SMTC Configuration | Config 1, 2 | | FR1 patterm 1 | FR1 patterm 1 |
| | Config 3 | | FR1 patterm 2 | FR1 patterm 2 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 | | 15 KHz | 15 KHz |
| | Config 3 | | 30 KHz | 30 KHz |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *OFF* | *OFF* |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1, 2 | slot | [5] | [5] |
| | Config 3 | | [10] | [10] |
| T1 | | s | 1 | 1 |
| T2 | | s | 0.4 | 0.4 |
| T3 | | s | [0.6] | [0.6] |
| D1 | | s | [0.24] | [0.44] |

| Note 1: UE-specific PDCCH is not transmitted after T1 starts. |
|---|

**Table A.6.5.1.5.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in non-DRX mode**

| Parameter | | Unit | Test 1 | | | Test 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | [-98] | | |
| | Config 2 | | [-98] | | | [-98] | | |
| | Config 3 | | [-98] | | | [-98] | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | [TDL-C 300ns 100Hz] | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.1.5.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.6.5.1.5.1-3: Measurement gap configuration for FR1 CSI-RS out-of-sync radio link monitoring in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |
| Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap) | |

**Table A.6.5.1.5.1-4: NZP-CSI-RS resource configuration for FR1 CSI-RS out-of-sync radio link monitoring in non-DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation[Note 2] | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.6.5.1.5.1-1 | | |

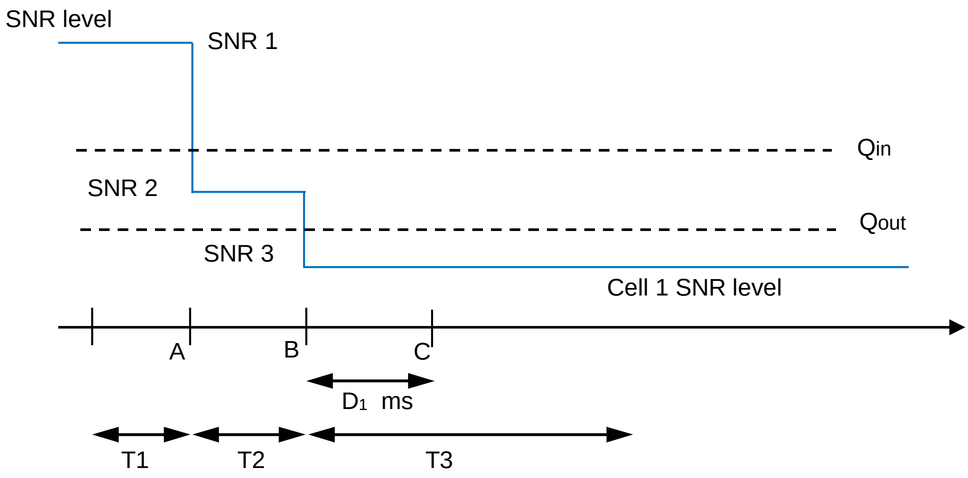


**Figure A.6.5.1.5.1-1: SNR variation for CSI-RS out-of-sync testing**

#### A.6.5.1.5.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 no later than time point C ($D_1$ = [TBD] ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

### A.6.5.1.6 Radio Link Monitoring In-sync Test for FR1 PCell configured with CSI-RS-based RLM in non-DRX mode

#### A.6.5.1.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR1 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.6.5.1.6.1-1, A.6.5.1.6.1-2, A.6.5.1.6.1-3, A.6.5.1.6.1-4, A.6.5.1.6.1-5, and A.6.5.1.6.1-6 below. There is one cells, cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.1.6.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] or [10] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 4.

**Table A.6.5.1.6.1-1: Supported test configurations for FR1 PCell**

| Configuration | Description |
|---|---|
| 1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 3 | TDD duplex mode, 30kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.6.5.1.6.1-2: General test parameters for FR1 PCell for CSI-RS in-sync testing in non-DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 3 | Test 4 |
| Active PCell | | | Cell 1 | Cell 1 |
| RF Channel Number | | | 1 | 1 |
| Duplex mode | Config 1 | | FDD | FDD |
| | Config 2, 3 | | TDD | TDD |
| TDD Configuration | Config 1 | | Not Applicable | Not Applicable |
| | Config 2 | | [TDDConf.1.1] | [TDDConf.1.1] |
| | Config 3 | | [TDDConf.1.2] | [TDDConf.1.2] |
| CORESET Reference Channel | Config 1 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] |
| | Config 2 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] |
| | Config 3 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 2 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 3 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| SMTC Configuration | Config 1, 2 | | FR1 patterm 1 | FR1 patterm 1 |
| | Config 3 | | FR1 patterm 2 | FR1 patterm 2 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 | | 15 KHz | 15 KHz |
| | Config 3 | | 30 KHz | 30 KHz |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| In sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 4 | 4 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *OFF* | *OFF* |
| Gap pattern ID | | | [N.A.] | *[*gp0*]* |
| Layer 3 filtering | | | *Enabled* | *Enabled* |

| | | | | |
|---|---|---|---|---|
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1, 2 | slot | [5] | [5] |
| | Config 3 | | [10] | [10] |
| T1 | | s | 1 | 1 |
| T2 | | s | 0.4 | 0.4 |
| T3 | | s | [0.6] | [0.6] |
| D1 | | s | [0.24] | [0.44] |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | |

**Table A.6.5.1.6.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode**

| Parameter | | Unit | Test 3 | | | Test 4 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | [-98] | | |
| | Config 2 | | [-98] | | | [-98] | | |
| | Config 3 | | [-98] | | | [-98] | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | [TDL-C 300ns 100Hz] | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.1.6.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.6.5.1.6.1-3: Measurement gap configuration for FR1 CSI-RS in-sync radio link monitoring in non-DRX mode**

| Field | Test 4 |
|---|---|
| | Value |
| gapOffset | [0] |
| Note 1: RLM RS is partially overlapped with measurement gap | |

**Table A.6.5.1.6.1-4: NZP-CSI-RS resource configuration for FR1 CSI-RS in-sync radio link monitoring in non-DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation Note 2 | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.4.5.1.6.1-1 | | |

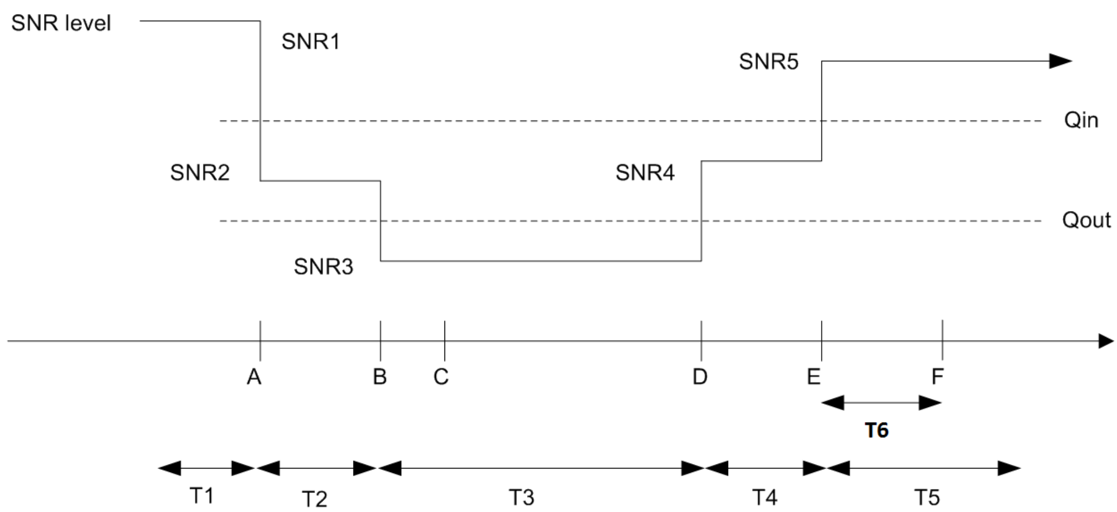


**Figure A.6.5.1.6.1-1: SNR variation for CSI-RS in-sync testing**

### A.6.5.1.6.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

## A.6.5.1.7 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM in DRX mode

### A.6.5.1.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.6.5.1.7.1-1, A.6.5.1.7.1-2, and A.6.5.1.7.1-3 below. There is one cell, cell 1 is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.6.5.1.7.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] or [10] ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 6.

**Table A.6.5.1.7.1-1: Supported test configurations for FR1 PCell**

| Configuration | Description |
|---|---|
| 1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 3 | TDD duplex mode, 30kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.6.5.1.7.1-2: General test parameters for FR1 PCell for CSI-RS out-of-sync testing in DRX mode**

| Parameter | | Unit | Value Test 5 | Value Test 6 |
|---|---|---|---|---|
| Active PCell | | | Cell 1 | Cell 1 |
| RF Channel Number | | | 1 | 1 |
| Duplex mode | Config 1 | | FDD | FDD |
| | Config 2, 3 | | TDD | TDD |
| TDD Configuration | Config 1 | | Not Applicable | Not Applicable |
| | Config 2 | | [TDDConf.1.1] | [TDDConf.1.1] |
| | Config 3 | | [TDDConf.1.2] | [TDDConf.1.2] |
| CORESET Reference Channel | Config 1 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] |
| | Config 2 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] |
| | Config 3 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 2 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 3 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| SMTC Configuration | Config 1, 2 | | FR1 patterm 1 | FR1 patterm 1 |
| | Config 3 | | FR1 pattern 2 | FR1 pattern 2 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 | | 15 KHz | 15 KHz |
| | Config 3 | | 30 KHz | 30 KHz |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *640* | *640* |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1, 2 | slot | [5] | [5] |
| | Config 3 | | [10] | [10] |
| T1 | | s | 1 | 1 |
| T2 | | s | 0.4 | 0.4 |
| T3 | | s | [0.6] | [0.6] |
| D1 | | s | [0.24] | [0.44] |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | |

**Table A.6.5.1.7.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in DRX mode**

| Parameter | | Unit | Test 5 | | | Test 6 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15K Hz | [-98] | | | [-98] | | |
| | Config 2 | | [-98] | | | [-98] | | |
| | Config 3 | | [-98] | | | [-98] | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | [TDL-C 300ns 100Hz] | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.1.7.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.6.5.1.7.1-3: Measurement gap configuration for FR1 CSI-RS out-of-sync radio link monitoring in DRX mode**

| Field | Test 6 |
|---|---|
| | Value |
| gapOffset | [0] |

Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap)

**Table A.6.5.1.7.1-4: NZP-CSI-RS resource configuration for FR1 CSI-RS out-of-sync radio link monitoring in DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation Note 1 | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |

Note 1: TS 38.211 [6] table 7.4.1.5.3-1
Note 2: nrofRBs is derived based on the Configuration in Table A.4.5.1.7.1-1

**Table A.6.5.1.7.1-5: DRX-Configuration for FR1 CSI-RS out-of-sync radio link monitoring in DRX mode.**

| Field | Test 5 | Test 6 |
|---|---|---|
| | Value | Value |
| drx-onDurationTimer | [ms6] | [ms6] |
| drx-InactivityTimer | [ms1] | [ms1] |
| drx-RetransmissionTimerDL | [sl1] | [sl1] |
| drx-RetransmissionTimerUL | [sl1] | [sl1] |
| longDRX-CycleStartOffset | [ms640] | [ms40] |
| shortDRX | disable | disable |

**Table A.6.5.1.7.1-6: TimeAlignmentTimer -Configuration for FR1 CSI-RS out-of-sync radio link monitoring in DRX mode.**

| Field | | Test 5 | Test 6 |
|---|---|---|---|
| | | Value | Value |
| TimeAlignmentTimer | | infinity | infinity |
| periodicityAndOffset in SchedulingRequestResourceConfig | Config 1, 2 | [sl5] | [sl5] |
| | Config 3 | [sl10] | [sl10] |

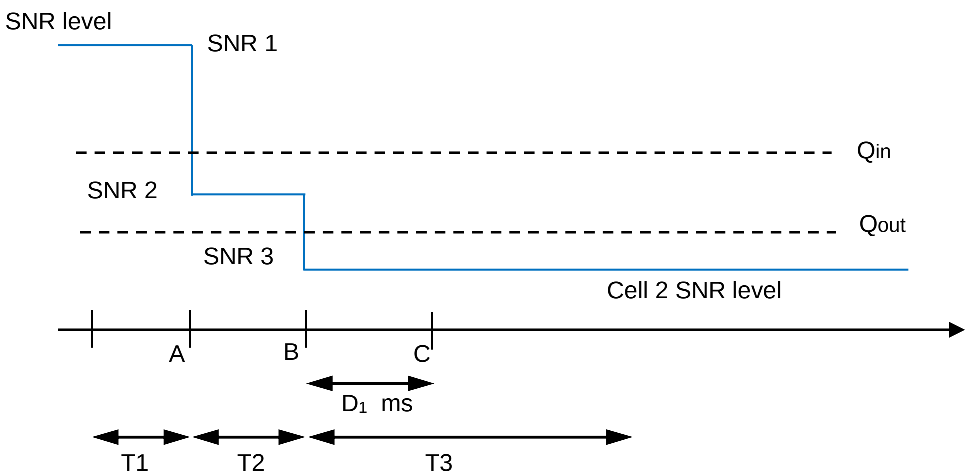


**Figure A.6.5.1.7.1-1: SNR variation for CSI-RS out-of-sync testing**

### A.6.5.1.7.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on PCell.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 (PCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 (PCell) no later than time point C ($D_1$ = [TBD] ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

### A.6.5.1.8 Radio Link Monitoring In-sync Test for FR1 PCell configured with CSI-RS-based RLM in DRX mode

#### A.6.5.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR1 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.6.5.1.8.1-1, A.6.5.1.81-2, A.6.5.1.8.1-3 and A.6.5.1.8.1-4 below. There is one cells, cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.1.8.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] or [10] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 7.

**Table A.6.5.1.8.1-1: Supported test configurations for FR1 PSCell**

| Configuration | Description |
|---|---|
| 1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 3 | TDD duplex mode, 30kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.6.5.1.8.1-2: General test parameters for FR1 PCell for CSI-RS in-sync testing in non-DRX mode**

| Parameter | | Unit | Value Test 7 | Value Test 8 |
|---|---|---|---|---|
| Active PCell | | | Cell 1 | Cell 1 |
| RF Channel Number | | | 1 | 1 |
| Duplex mode | Config 1 | | FDD | FDD |
| | Config 2, 3 | | TDD | TDD |
| TDD Configuration | Config 1 | | Not Applicable | Not Applicable |
| | Config 2 | | [TDDConf.1.1] | [TDDConf.1.1] |
| | Config 3 | | [TDDConf.1.2] | [TDDConf.1.2] |
| CORESET Reference Channel | Config 1 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] |
| | Config 2 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] |
| | Config 3 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 2 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| | Config 3 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| SMTC Configuration | Config 1, 2 | | FR1 patterm 1 | FR1 patterm 1 |
| | Config 3 | | FR1 pattern 2 | FR1 pattern 2 |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 | | 15 KHz | 15 KHz |
| | Config 3 | | 30 KHz | 30 KHz |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| In sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 4 | 4 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | 640 | 640 |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |

| | | | | |
|---|---|---|---|---|
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1, 2, 4, 5 | slot | [5] | [5] |
| | Config 3, 6 | | [10] | [10] |
| T1 | | s | 1 | 1 |
| T2 | | s | 0.4 | 0.4 |
| T3 | | s | [0.6] | [0.6] |
| D1 | | s | [0.24] | [0.44] |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | |

**Table A.6.5.1.8.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode**

| Parameter | | Unit | Test 7 | | | Test 8 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | [-98] | | |
| | Config 2 | | [-98] | | | [-98] | | |
| | Config 3 | | [-98] | | | [-98] | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | [TDL-C 300ns 100Hz] | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.1.8.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.6.5.1.8.1-3: Measurement gap configuration for FR1 CSI-RS in-sync radio link monitoring in non-DRX mode**

| Field | Test 8 |
|---|---|
| | Value |
| gapOffset | [0] |
| Note 1: RLM RS is partially overlapped with measurement gap | |

**Table A.6.5.1.8.1-4: NZP-CSI-RS resource configuration for FR1 CSI-RS in-sync radio link monitoring in non-DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation[Note 1] | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.4.5.1.8.1-1 | | |

**Table A.6.5.1.8.1-5: DRX-Configuration for FR1 CSI-RS in-sync radio link monitoring in DRX mode**

| Field | Test 5 | Test 6 |
|---|---|---|
| | Value | Value |
| drx-onDurationTimer | [ms6] | [ms6] |
| drx-InactivityTimer | [ms1] | [ms1] |
| drx-RetransmissionTimerDL | [sl1] | [sl1] |
| drx-RetransmissionTimerUL | [sl1] | [sl1] |
| longDRX-CycleStartOffset | [ms640] | [ms40] |
| shortDRX | disable | disable |

**Table A.6.5.1.8.1-6: TimeAlignmentTimer -Configuration for FR1 CSI-RS in-sync radio link monitoring in DRX mode**

| Field | | Test 5 | Test 6 |
|---|---|---|---|
| | | Value | Value |
| TimeAlignmentTimer | | infinity | infinity |
| periodicityAndOffset in SchedulingRequestResourceConfig | Config 1, 2 | [sl5] | [sl5] |
| | Config 3 | [sl10] | [sl10] |

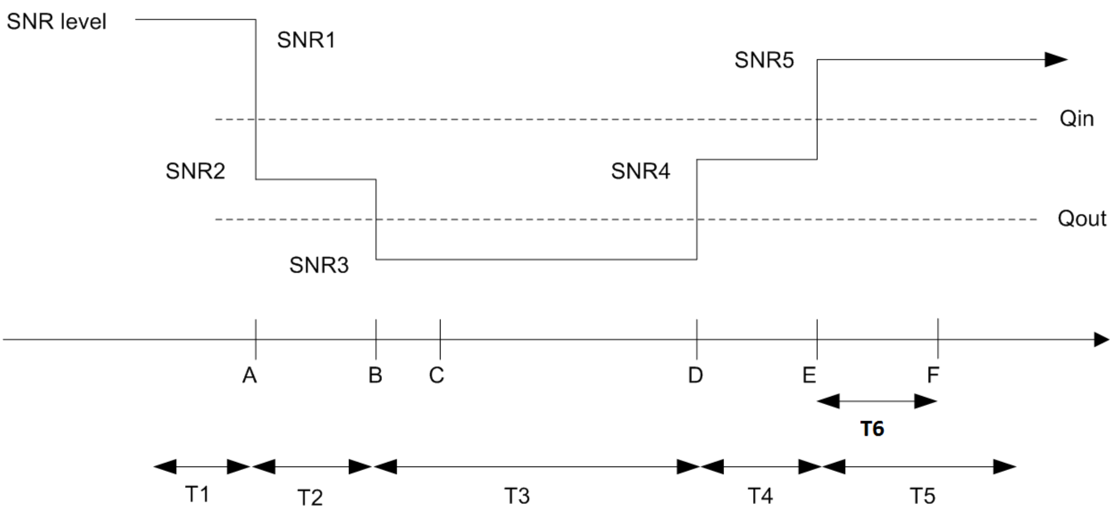


**Figure A.6.5.1.8.1-1: SNR variation for CSI-RS in-sync testing**

#### A.6.5.1.8.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

### A.6.5.2 Interruption

### A.6.5.3 SCell Activation and Deactivation Delay

### A.6.5.4 UE UL carrier RRC reconfiguration Delay

#### A.6.5.4.1 Test Purpose and Environment

The purpose of this test is to verify that when the UE receives a RRC message implying NR UL or Supplementary UL carrier configuration, the UE shall be ready to start transmission on the newly configured carrier within the time limits specified in section 8.4.2 and 8.4.3 for configuring and deconfiguring, respectively.

There are two cells: FR1 PCell (cell 1) and FR1 SCell (cell 2). Both NR uplink and supplementary uplink are broadcast by *ServingCellConfigCommonSIB.* The test parameters for PCell and SCell are given in Table A. 6.5.4.1-1, Table A.6.5.4.1-2, Table A.6.5.4.1-3 and Table A.6.5.4.1-4 below. In test 1, the test consists of three time periods, with duration of T1, T2 and T3 respectively. During time duration T1, NR uplink of cell 2 is configured to UE. At the start of T2, a supplementary uplink of cell 2 is configured to UE through *RRCReconfiguration*, then UE shall start transmission both on the NR uplink and supplementary uplink. At the start of T3, the supplementary uplink is released through *RRCReconfiguration*.

In test 2, the test consists of three time periods, with duration of T1, T2 and T3 respectively. During time duration T1, supplementray uplink on cell 2 is configured to UE. At the start of T2, a NR uplink is configured to UE through *RRCReconfiguration*, then UE shall start transmission both on the NR uplink and supplementary uplink. At the start of T3, the NR uplink is released through *RRCReconfiguration*.

**Table A.6.5.4.1-1: Supported test configurations**

| Configuration | PSCell (Cell 1) | SCell (Cell 2) |
|---|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | DL and UL: 15kHz SSB SCS, 10MHz bandwidth, FDD duplex mode;<br>SUL: 15kHz SCS, 10MHz bandwidth, SUL duplex mode |
| 2 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | DL and UL: 15kHz SSB SCS, 10MHz bandwidth, TDD duplex mode;<br>SUL: 15kHz SCS, 10MHz bandwidth, SUL duplex mode |
| 3 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | DL and UL: 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode;<br>SUL: 30kHz SCS, 40MHz bandwidth, SUL duplex mode |
| 4 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | DL and UL: 15kHz SSB SCS, 10MHz bandwidth, FDD duplex mode;<br>SUL: 15kHz SCS, 10MHz bandwidth, SUL duplex mode |
| 5 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | DL and UL: 15kHz SSB SCS, 10MHz bandwidth, TDD duplex mode;<br>SUL: 15kHz SCS, 10MHz bandwidth, SUL duplex mode |
| 6 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | DL and UL: 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode;<br>SUL: 30kHz SCS, 40MHz bandwidth, SUL duplex mode |

| | | |
|---|---|---|
| 7 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | DL and UL: 15kHz SSB SCS, 10MHz bandwidth, FDD duplex mode;<br>SUL: 15kHz SCS, 10MHz bandwidth, SUL duplex mode |
| 8 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | DL and UL: 15kHz SSB SCS, 10MHz bandwidth, TDD duplex mode;<br>SUL: 15kHz SCS, 10MHz bandwidth, SUL duplex mode |
| 9 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | DL and UL: 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode;<br>SUL: 30kHz SCS, 40MHz bandwidth, SUL duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | | |

**Table A.6.5.4.1-2: General test parameters for NR standalone UE UL carrier RRC reconfiguration Delay on Pcell**

| Parameter | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|
| RF Channel Number | | Config 1,2,3, 4, 5, 6, 7, 8, 9 | 1, 2 | Three radio channels are used for these two tests. |
| Active cell | | Config 1,2,3, 4, 5, 6, 7, 8, 9 | Cell 1: FR1 PCell<br>Cell 2: FR1 SCell | E-UTRAN PCell on RF channel number 1<br>FR1 SCell on RF channel number 2 |
| CP length | | Config 1,2,3, 4, 5, 6, 7, 8, 9 | Normal | |
| DRX | | Config 1,2,3, 4, 5, 6, 7, 8, 9 | OFF | |
| Measurement gap pattern Id | | Config 1,2,3, 4, 5, 6, 7, 8, 9 | OFF | |
| Filter coefficient | | Config 1,2,3, 4, 5, 6, 7, 8, 9 | 0 | L3 filtering is not used |
| T1 | s | Config 1,2,3, 4, 5, 6, 7, 8, 9 | 5 | |
| T2 | s | Config 1,2,3, 4, 5, 6, 7, 8, 9 | 5 | |
| T3 | s | Config 1,2,3, 4, 5, 6, 7, 8, 9 | 5 | |

**Table A.6.5.4.1-3: NR Cell specific test parameters for NR standalone UE UL carrier RRC reconfiguration Delay on PCell (Cell 1)**

| Parameter | Unit | Test Configuration | Test 1 | | | Test 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Channel number | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 2 | | | 2 | | |
| TDD configuration | | Conf 1, 2, 3 | N/A | | | N/A | | |
| | | Conf 4, 5, 6 | TDD Conf.1.1 | | | TDD Conf.1.1 | | |
| | | Conf 7, 8, 9 | TDD Conf.2.1 | | | TDD Conf.2.1 | | |
| $BW_{channel}$ | MHz | Conf 1, 2, 3 | 10: $N_{RB,c}$ = 52 | | | 10: $N_{RB,c}$ = 52 | | |
| | | Conf 4, 5, 6 | 10: $N_{RB,c}$ = 52 | | | 10: $N_{RB,c}$ = 52 | | |
| | | Conf 7, 8, 9 | 40: $N_{RB,c}$ = 106 | | | 40: $N_{RB,c}$ = 106 | | |
| PDSCH reference measurement channel as defined in A.3.1.1 | | Conf 1, 2, 3 | SR.1.1 FDD | | | SR.1.1 FDD | | |
| | | Conf 4, 5, 6 | SR.1.1 TDD | | | SR.1.1 TDD | | |
| | | Conf 7, 8, 9 | SR 2.1 TDD | | | SR 2.1 TDD | | |
| RMSI CORESET reference measurement channel as defined in A.3.1.2 | | Conf 1, 2, 3 | CR.1.1 FDD | | | CR.1.1 FDD | | |
| | | Conf 4, 5, 6 | CR.1.1 TDD | | | CR.1.1 TDD | | |
| | | Conf 7, 8, 9 | CR.2.1 TDD | | | CR.2.1 TDD | | |
| RMC CORESET reference measurement channel as defined in A.3.1.3 | | Conf 1, 2, 3 | CCR.1.1 FDD | | | CCR.1.1 FDD | | |
| | | Conf 4, 5, 6 | CCR.1.1 TDD | | | CCR.1.1 TDD | | |
| | | Conf 7, 8, 9 | CCR.2.1 TDD | | | CCR.2.1 TDD | | |
| OCNG Pattern Note 1 | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | OP.1 | | | OP.1 | | |
| SSB configuration | | Conf 1, 2, 3, 4, 5, 6 | SSB.1 FR1 | | | SSB.1 FR1 | | |
| | | Conf 7, 8, 9 | SSB.2 FR1 | | | SSB.2 FR1 | | |
| SMTC configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | SMTC.1 | | | SMTC.1 | | |
| DL initial BWP configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | DLBWP.0.1 | | | DLBWP.0.1 | | |
| DL dedicated BWP configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | DLBWP.1.1 | | | DLBWP.1.1 | | |
| UL dedicated BWP configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | ULBWP.1.1 | | | ULBWP.1.1 | | |
| EPRE ratio of PSS to SSS | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 0 | | | 0 | | |
| EPRE ratio of PBCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | | | | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | | | | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS | | | | | | | | |
| $N_{oc}$ Note 2 | dBm / 15kHz | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | -102 | | | -102 | | |
| | dBm/ SCS | Conf 1,2,3,4,5,6 | -102 | | | -102 | | |
| | | Conf 7,8,9 | -99 | | | -99 | | |
| $\hat{E}_s / N_{oc}$ | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 16 | 16 | 16 | 16 | 16 | 16 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\hat{E}_s/I_{ot}$ Note 3 | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 16 | 16 | 16 | 16 | 16 | 16 |
| SS-RSRP Note 3 | dBm/SCS | Conf 1,2,3,4,5,6 | -86 | -86 | -86 | -86 | -86 | -86 |
| | | Conf 7,8,9 | -83 | -83 | -83 | -83 | -83 | -83 |
| Io Note 3 | dBm/9.36 MHz | Conf 1,2,3,4,5,6 | -57.9 | -57.9 | -57.9 | -57.9 | -57.9 | -57.9 |
| | dBm/38.16 MHz | Conf 7,8,9 | -51.8 | -51.8 | -51.8 | -51.8 | -51.8 | -51.8 |
| Propagation Condition | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | AWGN | | | AWGN | | |
| Antenna configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 1 x 2 | | | 1 x 2 | | |

NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.
NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
NOTE 3: $\hat{E}_s/I_{ot}$ , Io, and SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

**Table A.6.5.4.1-4: NR Cell specific test parameters for NR standalone UE UL carrier RRC reconfiguration Delay on SCell (Cell 2)**

| Parameter | Unit | Test Configuration | Test 1 | | | Test 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Channel number | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 3 | | | 3 | | |
| TDD configuration | | Conf 1, 4, 7 | N/A | | | N/A | | |
| | | Conf 2, 5, 8 | TDDConf.1.1 | | | TDDConf.1.1 | | |
| | | Conf 3, 6, 9 | TDDConf.2.1 | | | TDDConf.2.1 | | |
| $BW_{channel}$ | MHz | Conf 1, 4, 7 | 10: $N_{RB,c}$ = 52 | | | 10: $N_{RB,c}$ = 52 | | |
| | | Conf 2, 5, 8 | 10: $N_{RB,c}$ = 52 | | | 10: $N_{RB,c}$ = 52 | | |
| | | Conf 3, 6, 9 | 40: $N_{RB,c}$ = 106 | | | 40: $N_{RB,c}$ = 106 | | |
| PUSCH parameters for NR UL carrier | | Conf 1, 4, 7 | [TBD] | [TBD] | [TBD] | N/A | [TBD] | N/A |
| | | Conf 2, 5, 8 | [TBD] | [TBD] | [TBD] | N/A | [TBD] | N/A |
| | | Conf 3, 6, 9 | [TBD] | [TBD] | [TBD] | N/A | [TBD] | N/A |
| PUCCH parameters For NR UL carrier | | Conf 1, 4, 7 | [TBD] | [TBD] | [TBD] | N/A | [TBD] | N/A |
| | | Conf 2, 5, 8 | [TBD] | [TBD] | [TBD] | N/A | [TBD] | N/A |
| | | Conf 3, 6, 9 | [TBD] | [TBD] | [TBD] | N/A | [TBD] | N/A |
| PUSCH parameters for supplementary UL | | Conf 1, 4, 7 | N/A | [TBD] | N/A | [TBD] | [TBD] | [TBD] |
| | | Conf 2, 5, 8 | N/A | [TBD] | N/A | [TBD] | [TBD] | [TBD] |
| | | Conf 3, 6, 9 | N/A | [TBD] | N/A | [TBD] | [TBD] | [TBD] |
| PUCCH parameters for supplementary UL | | Conf 1, 4, 7 | N/A | [TBD] | N/A | [TBD] | [TBD] | [TBD] |
| | | Conf 2, 5, 8 | N/A | [TBD] | N/A | [TBD] | [TBD] | [TBD] |
| | | Conf 3, 6, 9 | N/A | [TBD] | N/A | [TBD] | [TBD] | [TBD] |
| PDSCH reference measurement channel as defined in A.3.1.1 | | Conf 1, 4, 7 | SR.1.1 FDD | | | SR.1.1 FDD | | |
| | | Conf 2, 5, 8 | SR.1.1 TDD | | | SR.1.1 TDD | | |
| | | Conf 3, 6, 9 | SR 2.1 TDD | | | SR 2.1 TDD | | |
| RMSI CORESET reference measurement channel as defined in A.3.1.2 | | Conf 1, 4, 7 | CR.1.1 FDD | | | CR.1.1 FDD | | |
| | | Conf 2, 5, 8 | CR.1.1 TDD | | | CR.1.1 TDD | | |
| | | Conf 3, 6, 9 | CR.2.1 TDD | | | CR.2.1 TDD | | |
| RMC CORESET reference measurement channel as defined in A.3.1.3 | | Conf 1, 4, 7 | CCR.1.1 FDD | | | CCR.1.1 FDD | | |
| | | Conf 2, 5, 8 | CCR.1.1 TDD | | | CCR.1.1 TDD | | |
| | | Conf 3, 6, 9 | CCR.2.1 TDD | | | CCR.2.1 TDD | | |
| OCNG Pattern Note 1 | | Conf 1, 2, 3 | OP.1 | | | OP.1 | | |
| SSB configuration | | Conf 1, 2, 4, 5, 7,8 | SSB.1 FR1 | | | SSB.1 FR1 | | |
| | | Conf 3, 6, 9 | SSB.2 FR1 | | | SSB.2 FR1 | | |
| SMTC configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | SMTC.1 | | | SMTC.1 | | |
| DL initial BWP configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | DLBWP.0.1 | | | DLBWP.0.1 | | |
| DL dedicated BWP configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | DLBWP.1.1 | | | DLBWP.1.1 | | |
| UL dedicated BWP configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | ULBWP.1.1 | | | ULBWP.1.1 | | |
| EPRE ratio of PSS to SSS | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 0 | | | 0 | | |
| EPRE ratio of PBCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | | | | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | | | | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| EPRE ratio of OCNG DMRS to SSS | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS | | | | | | | | |
| $N_{oc}$ Note 2 | dBm / 15kHz | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | -102 | | | -102 | | |
| | dBm/ SCS | Conf 1, 2, 4, 5, 7,8 | -102 | | | -102 | | |
| | | Conf 3, 6, 9 | -99 | | | -99 | | |
| $\hat{E}_s/N_{oc}$ | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 16 | 16 | 16 | 16 | 16 | 16 |
| $\hat{E}_s/I_{ot}$ Note 3 | dB | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 16 | 16 | 16 | 16 | 16 | 16 |
| SS-RSRP Note 3 | dBm/ SCS | Conf 1, 2, 4, 5, 7,8 | -86 | -86 | -86 | -86 | -86 | -86 |
| | | Conf 3, 6, 9 | -83 | -83 | -83 | -83 | -83 | -83 |
| Io Note 3 | dBm/ 9.36 MHz | Conf 1, 2, 4, 5, 7,8 | -57.9 | -57.9 | -57.9 | -57.9 | -57.9 | -57.9 |
| | dBm/ 38.16 MHz | Conf 3, 6, 9 | -51.8 | -51.8 | -51.8 | -51.8 | -51.8 | -51.8 |
| Propagation Condition | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | AWGN | | | AWGN | | |
| Antenna configuration | | Conf 1, 2, 3, 4, 5, 6, 7, 8, 9 | 1 x 2 | | | 1 x 2 | | |
| NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>NOTE 3: $\hat{E}_s/I_{ot}$, Io, and SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | | | |

#### A.6.5.4.2 Test Requirements

In test 1 the UE shall be ready to start transmission on the supplementary uplink carrier on SCell within [20]ms from the start of T2.

In test 1 the UE shall stop the transmission on the supplementary uplink carrier on SCell within [20]ms from the start of T3.

In test 2 the UE shall be ready to start transmission on the NR uplink carrier on SCell within [20]ms from the start of T2.

In test 2 the UE shall stop the transmission on the NR uplink carrier on SCell within [20]ms from the start of T3.

All of the above test requirements shall be fulfilled in order for the observed UE UL carrier configuration delay and UE UL carrier release delay to be counted as correct. The rate of correct observed UE UL carrier configuration delay and UE UL carrier release delay during repeated tests shall be at least 90%.

## A.6.5.5 Beam Failure Detection and Link recovery procedures

### A.6.5.5.1 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with SSB-based BFD and LR in non-DRX mode

*Editor's note: It is open whether BFD can be based on SSB. This test case will be updated accordingly.*

#### A.6.5.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set $q_0$ configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candicate set $q_1$. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.6.5.5.1.1-1, A.6.5.5.1.1-2, A.6.5.5.1.1-3 and A.6.5.5.1.1-4 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.1.1-1 shows the variation of the downlink SNR of the SSB in set $q_0$ in the active cell to emulate SSB based beam failure. Figure A.6.5.5.1.1-1 additionally shows the variation of the downlink SNR of the SSB in set $q_1$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 2.

**Table A.6.5.5.1.1-1: Supported test configurations for FR1 PCell**

| Configuration | Description |
|---|---|
| 1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 3 | TDD duplex mode, 30kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.6.5.5.1.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode**

| Parameter | | Unit | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active PCell | | | Cell 1 | Cell 1 | |
| RF Channel Number | | | 1 | 1 | |
| Duplex mode | Config 1 | | FDD | FDD | |
| | Config 2, 3 | | TDD | TDD | |
| TDD Configuration | Config 1 | | Not Applicable | Not Applicable | |
| | Config 2 | | [TDDConf.1.1] | [TDDConf.1.1] | |
| | Config 3 | | [TDDConf.1.2] | [TDDConf.1.2] | |
| CORESET Reference Channel | Config 1 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] | |
| | Config 2 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] | |
| | Config 3 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] | |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| | Config 2 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| | Config 3 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| SMTC Configuration | Config 1, 2 | | FR1 patterm 1 | FR1 patterm 1 | |
| | Config 3 | | FR1 patterm 2 | FR1 patterm 2 | |
| PDSCH/ PDCCH subcarrier spacing | Config 1, 2 | | 15 KHz | 15 KHz | |
| | Config 3 | | 30 KHz | 30 KHz | |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] | |
| OCNG parameters | | | TBD | TBD | |
| CP length | | | Normal | Normal | |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] | |
| Beam failure detection transmission parameters | DCI format | | 1-0 | 1-0 | |
| | Number of Control OFDM symbols | | 2 | 2 | |
| | Aggregation level | CCE | 8 | 8 | |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | DMRS precoder granularity | | REG bundle size | REG bundle size | |
| | REG bundle size | | 6 | 6 | |
| DRX | | | *OFF* | *OFF* | |
| Gap pattern ID | | | [N.A.] | *[*gp0*]* | |

| | | | | | |
|---|---|---|---|---|---|
| ssb-Index | | | 2 | 2 | Number of SSB indexes used for beam failure detection |
| rlmInSyncOutOfSync Threshold | | | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | | TBD | TBD | Threshold used for $Q_{out\_LR\_SSB}$ |
| powerControlOffsetSS | | | NA | NA | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstance MaxCount | | | n2 | n2 | see TS 38.321 [7], section 5.17 |
| beamFailureDetection Timer | | | pbfd4 | pbfd4 | see TS 38.321 [7], section 5.17 |
| ZP CSI-RS configuation | | | TBD | TBD | |
| CSI-IM configuration | | | TBD | TBD | |
| Periodic CSI reporting | | | PUCCH | PUCCH | |
| CSI reporting periodicity | Config 1, 2 | slot | [5] | [5] | |
| | Config 3 | | [10] | [10] | |
| T1 | | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | s | 0.4 | 0.4 | |
| T3 | | s | [0.6] | [0.6] | |
| D1 | | s | [0.24] | [0.44] | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

**Table A.6.5.5.1.1-3: Cell specific test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode**

| Parameter | | Unit | Test 1 and Test 2 | | | | | Test 1 and Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SSB of set $q_0$ | | | | | SSB of set $q_1$ | | | | |
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| PDCCH_beta | | dB | 4 | | | | | 4 | | | | |
| PDCCH_DMRS_beta | | dB | 4 | | | | | 4 | | | | |
| PBCH_beta | | dB | 0 | | | | | 0 | | | | |
| PSS_beta | | dB | | | | | | | | | | |
| SSS_beta | | dB | | | | | | | | | | |
| PDSCH_beta | | dB | | | | | | | | | | |
| OCNG_beta | | dB | | | | | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | | | [-98] | | | | |
| | Config 2 | | [-98] | | | | | [-98] | | | | |
| | Config 3 | | [-98] | | | | | [-98] | | | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | | | [TDL-C 300ns 100Hz] | | | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.5.1.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.6.5.5.1.1-4: Measurement gap configuration for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

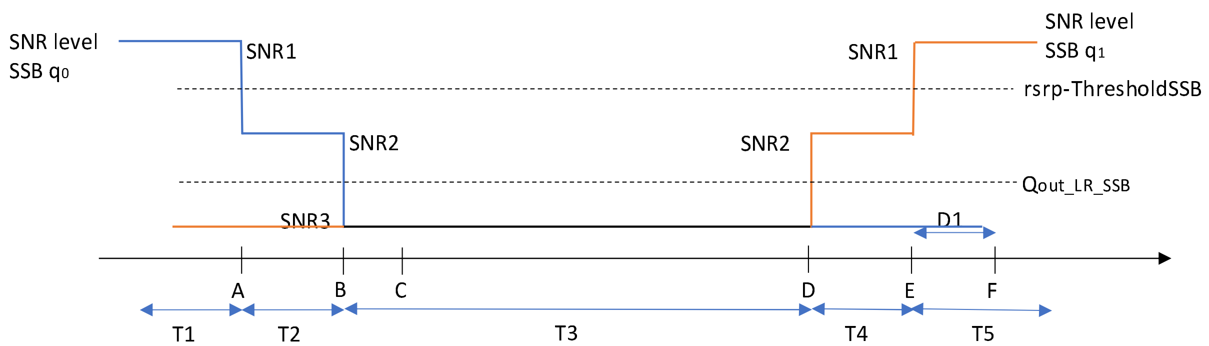


**Figure A.6.5.5.1.1-1: SNR variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode**

### A.6.5.5.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_1$.

No later than time point F occurring no later than D1 = [TBD] ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set $q_1$.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

### A.6.5.5.2 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with SSB-based BFD and LR in DRX mode

*Editor's note: It is open whether BFD can be based on SSB. This test case will be updated accordingly.*

#### A.6.5.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set $q_0$ configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candicate set $q_1$. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.6.5.5.2.1-1, A.6.5.5.2.1-2, A.6.5.5.2.1-3, A.6.5.5.2.1-4 and A.6.5.5.2.1-5 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.2.1-1 shows the variation of the downlink SNR of the SSB in set $q_0$ in the active cell to emulate SSB based beam failure. Figure A.6.5.5.2.1-1 additionally shows the variation of the downlink SNR of the SSB in set $q_1$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 2.

**Table A.6.5.5.2.1-1: Supported test configurations for FR1 PCell**

| Configuration | Description |
|---|---|
| 1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 3 | TDD duplex mode, 30kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.6.5.5.2.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode**

| Parameter | | Unit | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active PCell | | | Cell 1 | Cell 1 | |
| RF Channel Number | | | 1 | 1 | |
| Duplex mode | Config 1 | | FDD | FDD | |
| | Config 2, 3 | | TDD | TDD | |
| TDD Configuration | Config 1 | | Not Applicable | Not Applicable | |
| | Config 2 | | [TDDConf.1.1] | [TDDConf.1.1] | |
| | Config 3 | | [TDDConf.1.2] | [TDDConf.1.2] | |
| CORESET Reference Channel | Config 1 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] | |
| | Config 2 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] | |
| | Config 3 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] | |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| | Config 2 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| | Config 3 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| SMTC Configuration | Config 1, 2 | | FR1 patterm 1 | FR1 pattern 1 | |
| | Config 3 | | FR1 patterm 2 | FR1 pattern 2 | |
| PDSCH/PDCCH subcarrier spacing | Config 1, 2 | | 15 KHz | 15 KHz | |
| | Config 3 | | 30 KHz | 30 KHz | |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] | |
| OCNG parameters | | | TBD | TBD | |
| CP length | | | Normal | Normal | |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] | |
| Beam failure detection transmission parameters | DCI format | | 1-0 | 1-0 | |
| | Number of Control OFDM symbols | | 2 | 2 | |
| | Aggregation level | CCE | 8 | 8 | |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | DMRS precoder granularity | | REG bundle size | REG bundle size | |
| | REG bundle size | | 6 | 6 | |
| DRX | | | 640 | 640 | |
| Gap pattern ID | | | [N.A.] | *[*gp0*] | |

| | | | | | |
|---|---|---|---|---|---|
| ssb-Index | | | 2 | 2 | Number of SSB indexes used for beam failure detection |
| rlmInSyncOutOfSync Threshold | | | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | | TBD | TBD | Threshold used for $Q_{out\_LR\_SSB}$ |
| powerControlOffsetSS | | | NA | NA | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstance MaxCount | | | [n2] | [n2] | see TS 38.321 [7], section 5.17 |
| beamFailureDetection Timer | | | [pbfd4] | [pbfd4] | see TS 38.321 [7], section 5.17 |
| ZP CSI-RS configuation | | | TBD | TBD | |
| CSI-IM configuration | | | TBD | TBD | |
| Periodic CSI reporting | | | PUCCH | PUCCH | |
| CSI reporting periodicity | Config 1, 2 | slot | [5] | [5] | |
| | Config 3 | | [10] | [10] | |
| T1 | | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | s | 0.4 | 0.4 | |
| T3 | | s | [0.6] | [0.6] | |
| D1 | | s | [0.24] | [0.44] | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

**Table A.6.5.5.2.1-3: Cell specific test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode**

| Parameter | | Unit | Test 1 and Test 2 | | | | | Test 1 and Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SSB of set $q_0$ | | | | | SSB of set $q_1$ | | | | |
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| PDCCH_beta | | dB | 4 | | | | | 4 | | | | |
| PDCCH_DMRS_beta | | dB | 4 | | | | | 4 | | | | |
| PBCH_beta | | dB | 0 | | | | | 0 | | | | |
| PSS_beta | | dB | | | | | | | | | | |
| SSS_beta | | dB | | | | | | | | | | |
| PDSCH_beta | | dB | | | | | | | | | | |
| OCNG_beta | | dB | | | | | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/ 15K Hz | [-98] | | | | | [-98] | | | | |
| | Config 2 | | [-98] | | | | | [-98] | | | | |
| | Config 3 | | [-98] | | | | | [-98] | | | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | | | [TDL-C 300ns 100Hz] | | | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.5.2.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.6.5.5.2.1-4: Measurement gap configuration for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

**Table A.6.5.5.2.1-5: DRX-Configuration for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode.**

| Field | Test 5 | Test 6 |
|---|---|---|
| | Value | Value |
| drx-onDurationTimer | [ms6] | [ms6] |
| drx-InactivityTimer | [ms1] | [ms1] |
| drx-RetransmissionTimerDL | [sl1] | [sl1] |
| drx-RetransmissionTimerUL | [sl1] | [sl1] |
| longDRX-CycleStartOffset | [ms640] | [ms40] |
| shortDRX | disable | disable |

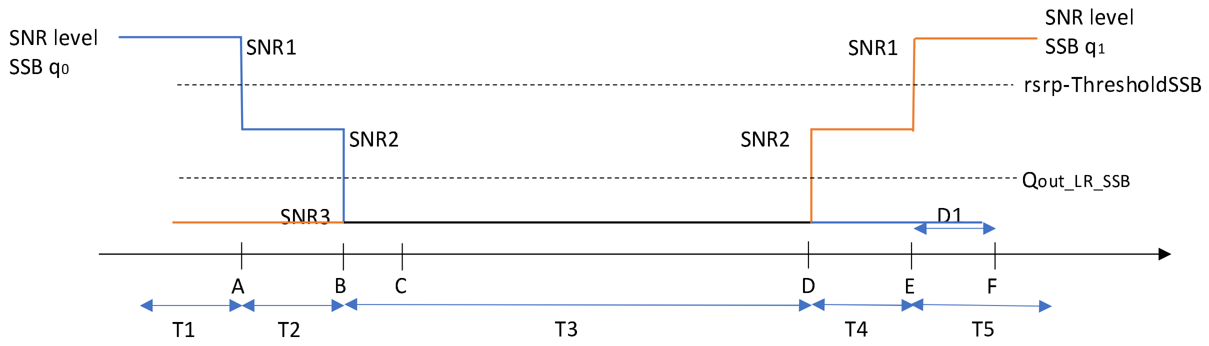


**Figure A.6.5.5.2.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in non-DRX mode**

### A.6.5.5.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_1$.

No later than time point F occurring no later than D1 = [TBD] ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set $q_1$.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

## A.6.5.5.3 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with CSI-RS-based BFD and LR in non-DRX mode

### A.6.5.5.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set $q_0$ configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set $q_1$. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.6.5.5.3.1-1, A.6.5.5.3.1-2, A.6.5.5.3.1-3, A.6.5.5.3.1-4 and A.6.5.5.3.1-5 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.3.1-1 shows the variation of the downlink SNR of the CSI-RS in set $q_0$ in the active cell to emulate CSI-RS based beam failure. Figure A.6.5.5.3.1-1 additionally shows the variation of the downlink SNR of the CSI-RS in set $q_1$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 2.

**Table A.6.5.5.3.1-1: Supported test configurations for FR1 PCell**

| Configuration | Description |
|---|---|
| 1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 3 | FDD duplex mode, 30kHz SSB SCS, 40MHz bandwidth |
| 4 | TDD duplex mode, 30kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.6.5.5.3.1-2: General test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode**

| Parameter | | Unit | Value Test 1 | Value Test 2 | Comment |
|---|---|---|---|---|---|
| Active PCell | | | Cell 1 | Cell 1 | |
| RF Channel Number | | | 1 | 1 | |
| Duplex mode | Config 1, 3 | | FDD | FDD | |
| | Config 2, 4 | | TDD | TDD | |
| TDD Configuration | Config 1, 3 | | Not Applicable | Not Applicable | |
| | Config 2 | | [TDDConf.1.1] | [TDDConf.1.1] | |
| | Config 4 | | [TDDConf.1.2] | [TDDConf.1.2] | |
| CORESET Reference Channel | Config 1 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] | A.3.1.2 |
| | Config 2 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] | |
| | Config 3 | | [CR. 2.1 FDD] | [CR. 2.1 FDD] | |
| | Config 4 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] | |
| SSB Configuration | Config 1 | | **SSB.1 FR1** | SSB.1 FR1 | A.3.10 |
| | Config 2 | | SSB.1 FR1 | SSB.1 FR1 | |
| | Config 3 | | **SSB.2 FR1** | SSB.2 FR1 | |
| | Config 4 | | SSB.2 FR1 | SSB.2 FR1 | |
| SMTC Configuration | Config 1, 2 | | FR1 patterm 1 | FR1 patterm 1 | A.3.11 |
| | Config 3, 4 | | FR1 patterm 2 | FR1 patterm 2 | |
| PDSCH/ PDCCH subcarrier spacing | Config 1, 2 | | 15 KHz | 15 KHz | |
| | Config 3, 4 | | 30 KHz | 30 KHz | |
| csi-RS-Index assigned as beam failure RS | | | [0] | [0] | |
| OCNG parameters | | | TBD | TBD | A.3.2.1 |
| CP length | | | Normal | Normal | |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] | |
| Beam failure detection transmission parameters | DCI format | | 1-0 | 1-0 | |
| | Number of Control OFDM symbols | | 2 | 2 | |
| | Aggregation level | CCE | 8 | 8 | |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | DMRS precoder granularity | | REG bundle size | REG bundle size | |
| | REG bundle size | | 6 | 6 | |
| DRX | | | OFF | OFF | |
| Gap pattern ID | | | [N.A.] | *[*gp0*] | |

| | | | | | |
|---|---|---|---|---|---|
| csi-RS-Index | | | 2 | 2 | Number of SSB indexes used for beam failure detection |
| rlmInSyncOutOfSyncThreshold | | | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | | TBD | TBD | Threshold used for $Q_{out\_LR\_SSB}$ |
| powerControlOffsetSS | | | db0 | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstanceMaxCount | | | n2 | n2 | see TS 38.321 [7], section 5.17 |
| beamFailureDetectionTimer | | | pbfd4 | pbfd4 | see TS 38.321 [7], section 5.17 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] | |
| ZP CSI-RS configuation | | | TBD | TBD | |
| Periodic CSI reporting | | | PUCCH | PUCCH | |
| CSI reporting periodicity | Config 1, 2 | slot | [5] | [5] | |
| | Config 3 | | [10] | [10] | |
| T1 | | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | s | 0.4 | 0.4 | |
| T3 | | s | [TBD] | [TBD] | |
| D1 | | s | [0.24] | [0.44] | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

**Table A.6.5.5.3.1-3: Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode**

| Parameter | | Unit | Test 1 and Test 2 | | | | | Test 1 and Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CSI-RS of set $q_0$ | | | | | CSI-RS of set $q_1$ | | | | |
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PSS to SSS | | dB | 0 | | | | | 0 | | | | |
| EPRE ratio of PBCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | dB | | | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | dB | | | | | | | | | | |
| SNR_CSI-RS | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | | | [-98] | | | | |
| | Config 2 | | [-98] | | | | | [-98] | | | | |
| | Config 3 | | [-98] | | | | | [-98] | | | | |
| SS-RSRP Note 3 | | dBm/SCS | | | | | | | | | | |
| Ês/Iot | | | | | | | | | | | | |
| Ês/Noc | | | | | | | | | | | | |
| Io | config 1, 2 | dBm/9.36 MHz | | | | | | | | | | |
| | Config 3, 4 | dBm/38.1 MHz | | | | | | | | | | |
| Propagation condition | | | [TDLC300] | | | | | [TDLC300] | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | | | | | | | |

**Table A.6.5.5.3.1-4: Measurement gap configuration for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

**Table A.6.5.5.3.1-5: NZP-CSI-RS resource configuration for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation Note 1 | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.4.5.1.7.1-1 | | |

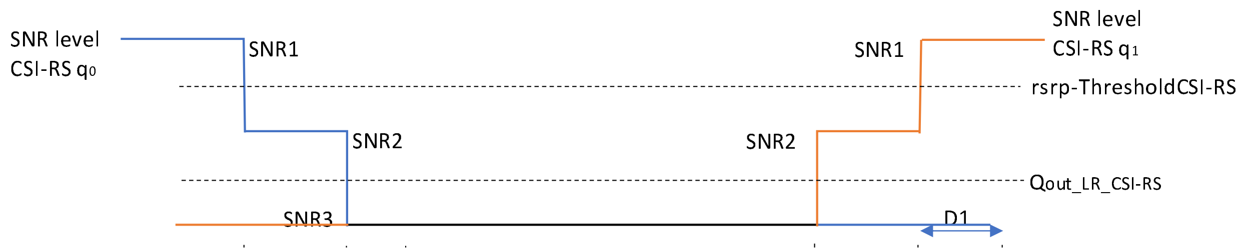


**Figure A.6.5.5.3.1-1: SNR variation SSB for CSI-rs-based beam failure detection and link recovery testing in non-DRX mode**

### A.6.5.5.3.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_1$.

No later than time point F occurring no later than D1 = [TBD] ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set $q_1$.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

## A.6.5.5.4 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with CSI-RS-based BFD and LR in DRX mode

### A.6.5.5.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set $q_0$ configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set $q_1$. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.6.5.5.4.1-1, A.6.5.5.4.1-2, A.6.5.5.4.1-3, A.6.5.5.4.1-4, A.6.5.5.4.1-5 and A.x.x.1.4.1-6 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.4.1-1 shows the variation of the downlink SNR of the CSI-RS in set $q_0$ in the active cell to emulate CSI-RS based beam failure. Figure A.6.5.5.4.1-1 additionally shows the variation of the downlink SNR of the CSI-RS in set $q_1$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 2.

**Table A.6.5.5.4.1-1: Supported test configurations for FR1 PCell**

| Configuration | Description |
|---|---|
| 1 | FDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 2 | TDD duplex mode, 15 kHz SSB SCS, 10MHz bandwidth |
| 3 | FDD duplex mode, 30kHz SSB SCS, 40MHz bandwidth |
| 4 | TDD duplex mode, 30kHz SSB SCS, 40MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR1 | |

**Table A.6.5.5.4.1-2: General test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

| Parameter | | Unit | Value Test 1 | Value Test 2 | Comment |
|---|---|---|---|---|---|
| Active PCell | | | Cell 1 | Cell 1 | |
| RF Channel Number | | | 1 | 1 | |
| Duplex mode | Config 1, 3 | | FDD | FDD | |
| | Config 2, 4 | | TDD | TDD | |
| TDD Configuration | Config 1, 3 | | Not Applicable | Not Applicable | |
| | Config 2 | | [TDDConf.1.1] | [TDDConf.1.1] | |
| | Config 3 | | [TDDConf.1.2] | [TDDConf.1.2] | |
| CORESET Reference Channel | Config 1 | | [CR. 1.1 FDD] | [CR. 1.1 FDD] | A.3.1.2 |
| | Config 2 | | [CR. 1.1 TDD] | [CR. 1.1 TDD] | |
| | Config 3 | | [CR. 2.1 FDD] | [CR. 2.1 FDD] | |
| | Config 4 | | [CR. 2.1 TDD] | [CR. 2.1 TDD] | |
| SSB Configuration | Config 1 | | SSB.1 FR1 | SSB.1 FR1 | A.3.10 |
| | Config 2 | | SSB.1 FR1 | SSB.1 FR1 | |
| | Config 3 | | SSB.2 FR1 | SSB.2 FR1 | A.3.11 |
| | Config 4 | | SSB.2 FR1 | SSB.2 FR1 | |
| SMTC Configuration | Config 1, 2 | | FR1 patterm 1 | FR1 patterm 1 | |
| | Config 3, 4 | | FR1 patterm 2 | FR1 patterm 2 | |
| PDSCH/ PDCCH subcarrier spacing | Config 1, 2 | | 15 KHz | 15 KHz | |
| | Config 3, 4 | | 30 KHz | 30 KHz | |
| csi-RS-Index assigned as Beam Failure RS | | | [0] | [0] | |
| OCNG parameters | | | TBD | TBD | A.3.2.1 |
| CP length | | | Normal | Normal | |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] | |
| Beam failure detection transmission parameters | DCI format | | 1-0 | 1-0 | |
| | Number of Control OFDM symbols | | 2 | 2 | |
| | Aggregation level | CCE | 8 | 8 | |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | DMRS precoder granularity | | REG bundle size | REG bundle size | |
| | REG bundle size | | 6 | 6 | |
| DRX | | | 640 | 640 | |
| Gap pattern ID | | | [N.A.] | *[*gp0*] | |

| | | | | | |
|---|---|---|---|---|---|
| csi-RS-Index | | | 2 | 2 | Number of SSB indexes used for beam failure detection |
| rlmInSyncOutOfSync Threshold | | | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | | TBD | TBD | Threshold used for $Q_{out\_LR\_SSB}$ |
| powerControlOffsetSS | | | db0 | db0 | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstance MaxCount | | | [n2] | [n2] | see TS 38.321 [7], section 5.17 |
| beamFailureDetection Timer | | | [pbfd4] | [pbfd4] | see TS 38.321 [7], section 5.17 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] | |
| ZP CSI-RS configuation | | | TBD | TBD | |
| Periodic CSI reporting | | | PUCCH | PUCCH | |
| CSI reporting periodicity | Config 1, 2 | slot | [5] | [5] | |
| | Config 3 | | [10] | [10] | |
| T1 | | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | s | 0.4 | 0.4 | |
| T3 | | s | [TBD] | [TBD] | |
| D1 | | s | [0.24] | [0.44] | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

**Table A.6.5.5.4.1-3: Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

| Parameter | | Unit | Test 1 and Test 2 | | | | | Test 1 and Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CSI-RS of set $q_0$ | | | | | CSI-RS of set $q_1$ | | | | |
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PSS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PBCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | 0 | | | | | 0 | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | dB | | | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | dB | | | | | | | | | | |
| SNR_CSI-RS | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | | | [-98] | | | | |
| | Config 2 | | [-98] | | | | | [-98] | | | | |
| | Config 3 | | [-98] | | | | | [-98] | | | | |
| SS-RSRP(Note 3) | | dBm/SCS | | | | | | | | | | |
| $\hat{E}_s/I_{ot}$ | | | | | | | | | | | | |
| $\hat{E}_s/N_{oc}$ | | | | | | | | | | | | |
| Io | config 1, 2 | dBm/9.36 MHz | | | | | | | | | | |
| | Config 3, 4 | dBm/38.1 MHz | | | | | | | | | | |
| Propagation condition | | | [TDLC300] | | | | | [TDLC300] | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | | | | | | | |

**Table A.6.5.5.4.1-4: Measurement gap configuration for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

**Table A.6.5.5.4.1-5: NZP-CSI-RS resource configuration for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation Note 1 | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.4.5.1.7.1-1 | | |

**Table A.6.5.5.4.1-6: DRX-Configuration for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode.**

| Field | Test 5 | Test 6 |
|---|---|---|
| | Value | Value |
| drx-onDurationTimer | [ms6] | [ms6] |
| drx-InactivityTimer | [ms1] | [ms1] |
| drx-RetransmissionTimerDL | [sl1] | [sl1] |
| drx-RetransmissionTimerUL | [sl1] | [sl1] |
| longDRX-CycleStartOffset | [ms640] | [ms40] |
| shortDRX | disable | disable |

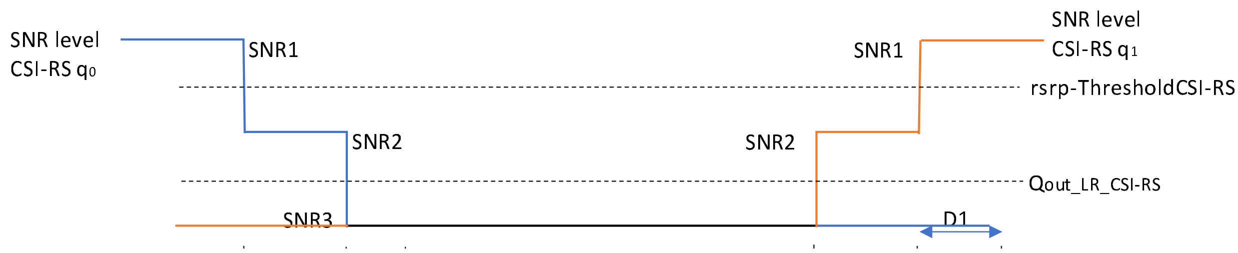


**Figure A.6.5.5.4.1-1: SNR variation SSB for CSI-rs-based beam failure detection and link recovery testing in DRX mode**

## A.6.5.5.4.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_1$.

No later than time point F occurring no later than D1 = [TBD] ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set $q_1$.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

## A.6.5.6 Active BWP switch delay

### A.6.5.6.1 DCI-based and Timer-based Active BWP Switch

#### A.6.5.6.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in section 8.6, and interruption requirement on other active serving cell defined in section 8.2.2.2.5.

The supported test configurations are shown in Table A.6.5.6.1.1.1-1 below. The test scenario comprises of one NR PCell (Cell 1) and one NR SCell (Cell 2) as given in Table A.6.5.6.1.1.1-2. NR Cell-specific parameters is specified in Table A.6.5.6.1.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 1 and the time duration of T2.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 2) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (SCell) on radio channel 2 (SCC).
- UE is configured with 2 different UE-specific bandwidth parts for PCell, BWP-1 and BWP-2, in Cell 1 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH no later than at PCell's slot ($i+T_{BWPswitchDelay}$) as defined in section 8.6 and starts to report valid ACK/NACK for the PCell no later than at slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PCell's BWP-2 no later than slot ($i+T_{BWPswitchDelay}$).

The starting time of SCell (Cell 2) interruption due to BWP switch on PCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PCell(Cell 1).

During T3,

The time period T3 starts from the slot #*j* immediately after the slot wherein *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH no later than PCell's slot ($j+T_{BWPswitchDelay}$) as defined in section 8.6 and starts to report valid ACK/NACK for the SCell at latest at slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on SCell's BWP-1 no later than slot ($j+T_{BWPswitchDelay}$).

The starting time of SCell (Cell 2) interruption due to BWP switch of PCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to SCell is carried out in the correct time span by monitoring ACK/NACK sent in SCell during BWP switch of PCell, respectively.

**Table A.6.5.6.1.1.1-1: DL BWP switch supported test configurations**

| Config | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD -FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD – TDD duplex mode |
| 3 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD – FDD duplex mode |
| 4 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD – TDD duplex mode |
| 5 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD - TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations | |

**Table A.6.5.6.1.1.1-2: General test parameters for DL BWP switch in SA**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| NR RF Channel Number | | 2 | Two NR radio channel is used for this test |
| Active PCell | | Cell 1 | PCell on RF channel number 1. |
| Active SCell | | Cell 2 | SCell on RF channel number 2. |
| CP length | | Normal | |
| DRX | | OFF | For both PCell and SCell |
| *bwp-InactivityTimer* | ms | [200] | |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on SCC. |
| Cell2 timing offset to cell1 | μs | 3 | Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1. |
| T1 | s | [0.2] | |
| T2 | s | [0.2] | |
| T3 | s | [0.2] | |

**Table A6.5.6.1.1.1-3: NR Cell specific test parameters for DL BWP switch in SA**

| Parameter | | Unit | Cell 1 | Cell2 |
|---|---|---|---|---|
| Frequency Range | | | FR1 | FR1 |
| Duplex mode | Config 1 | | FDD | FDD |
| | Config 2,5 | | TDD | TDD |
| | Config 3 | | TDD | FDD |
| | Config 4 | | FDD | TDD |
| TDD configuration | Config 1 | | Not Applicable | Not Applicable |
| | Config 2 | | TDDConf.1.1 | TDDConf.1.1 |
| | Config 3 | | TDDConf.1.1 | Not Applicable |
| | Config 4 | | Not Applicable | TDDConf.1.1 |
| | Config 5 | | TDDConf.1.2 | TDDConf.1.2 |
| $BW_{channel}$ | Config 1,2,3,4 | | 10 MHz: $N_{RB,c}$ = 52 | 10 MHz: $N_{RB,c}$ = 52 |
| | Config 5 | | 40 MHz: $N_{RB,c}$ = 106 | 40 MHz: $N_{RB,c}$ = 106 |
| Active BWP ID | | | 1, 2 | 3 |
| Initial BWP Configuration | | | DLBWP.0.2[Note4] | |
| Active BWP-1 Configuration | | | DLBWP.1.1[Note4] | - |
| Active BWP-2 Configuration | | | DLBWP.1.3[Note4] | - |
| PDSCH Reference measurement channel | Config 1 | | SR.1.1 FDD | SR.1.1 FDD |
| | Config 2 | | SR.1.1 TDD | SR.1.1 TDD |
| | Config 3 | | SR.1.1 TDD | SR.1.1 FDD |
| | Config 4 | | SR.1.1 FDD | SR.1.1 TDD |
| | Config 5 | | SR.2.1 TDD | SR.2.1 TDD |
| RMSI CORESET parameters | Config 1 | | CR.1.1 FDD | CR.1.1 FDD |
| | Config 2 | | CR.1.1 TDD | CR.1.1 TDD |
| | Config 3 | | CR.1.1 TDD | CR.1.1 FDD |
| | Config 4 | | CR.1.1 FDD | CR.1.1 TDD |
| | Config 5 | | CR.2.1 TDD | CR.2.1 TDD |
| Dedicated CORESET parameters | Config 1 | | CCR.1.1 FDD | CCR.1.1 FDD |
| | Config 2 | | CCR.1.1 TDD | CCR.1.1 TDD |
| | Config 3 | | CCR.1.1 TDD | CCR.1.1 FDD |
| | Config 4 | | CCR.1.1 FDD | CCR.1.1 TDD |
| | Config 5 | | CCR.2.1 TDD | CCR.2.1 TDD |
| OCNG Patterns | | | OP.1 | |
| SSB Configuration | Config 1,2,3,4 | | SSB.1 FR1 | |
| | Config 5 | | SSB.2 FR1 | |
| SMTC Configuration | | | SMTC.1 | |
| Correlation Matrix and Antenna Configuration | | | 1x2 Low | |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | |
| $N_{oc}$[Note 2] | Config 1,2,3,4 | dBm/SCS | [-104] | [-104] |
| | Config 5 | | [-110] | [-110] |
| $N_{oc}$[Note 2] | | dBm/15KHz | [-104] | [-104] |
| SS-RSRP [Note 3] | Config 1,2,3,4 | dBm/SCS | [-87] | [-87] |
| | Config 5 | | [-90] | [-90] |
| $\hat{E}_s/I_{ot}$ | | dB | [17] | [17] |
| $\hat{E}_s/N_{oc}$ | | dB | [17] | [17] |
| Io[Note3] | Config 1,2,3,4 | dBm/ 9.36MHz | [-59] | [-59] |
| | Config 5 | dBm/ 38.16MHz | [-61.9] | [-61.9] |
| Propagation Condition | | | AWGN | AWGN |

| |
|---|
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3 SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in TS 38.213 [3] section 12. |

##### A.6.5.6.1.1.2 Test Requirements

During T1, the UE shall start to send the ACK for SCell in a slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for SCell in a slot ($j+T_{BWPswitchDelay}+k1$).

Where, $k1$ is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in Table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1 and T3, the start time of SCell interruption during PCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of SCell shall not be longer than the interruption duration specified for active BWP switch in Section 8.2.2.2.5.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in a slot ($i+ T_{BWPswitchDelay}+k1$), ($j+ T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

#### A.6.5.6.1.1 NR FR1- NR FR1 DL active BWP switch of PCell with non-DRX in SA

### A.6.5.6.2 RRC-based Active BWP Switch

#### A.6.5.6.2.1 NR FR1- NR FR1 DL active BWP switch of PCell with non-DRX in SA

##### A.6.5.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in section 8.6. Supported test configurations are shown in Table A.6.5.6.2.1.1-1.

The test scenario comprises of one NR PCell (Cell 1) as given in Table A.6.5.6.2.1.1-2. Cell-specific parameters of NR PCell are specified in Table A.6.5.6.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PCell.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with bandwidth part configuration BWP-2, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH at PCell's slot ($i+X$) as defined in section 8.6 and starts to report valid ACK/NACK for the PCell no later than at slot ($i+X+k1$). The UE shall be continuously scheduled on PCell's BWP-2 starting from slot ($i+X$).

The test equipment verifies the DL BWP switch time in PCell by counting the slots from the time when the RRC Reconfiguration message including BWP switch command is received till an ACK is received.

**Table A.6.5.6.2.1.1-1: DL BWP switch supported test configurations**

| Config | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| 4 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 5 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 6 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations | |

**Table A.6.5.6.2.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| NR RF Channel Number | | 1 | One NR radio channel is used for this test |
| Active PCell | | Cell 1 | PCell on RF channel number 1. |
| CP length | | Normal | |
| DRX | | OFF | |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| T1 | s | [0.2] | |

**Table A.6.5.6.2.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | | Unit | Cell 1 |
|---|---|---|---|
| Frequency Range | | | FR1 |
| Duplex mode | Config 1,4 | | FDD |
| | Config 2,3,5,6 | | TDD |
| TDD configuration | Config 1,4 | | Not Applicable |
| | Config 2,5 | | TDDConf.1.1 |
| | Config 3,6 | | TDDConf.1.2 |
| $BW_{channel}$ | Config 1,4 | | 10 MHz: $N_{RB,c}$ = 52 |
| | Config 2,5 | | 10 MHz: $N_{RB,c}$ = 52 |
| | Config 3,6 | | 40 MHz: $N_{RB,c}$ = 106 |
| Active BWP ID | | | 1, 2 |
| Initial BWP Configuration | Config 1,4 | | DLBWP.0.2 |
| | Config 2,5 | | |
| | Config 3,6 | | |
| Active BWP-0 Configuration | Config 1,4 | | NA |
| | Config 2,5 | | |
| | Config 3,6 | | |
| Active BWP-1 Configuration | Config 1,4 | | DLBWP.1.3 |
| | Config 2,5 | | |
| | Config 3,6 | | |
| Active BWP-2 Configuration | Config 1,4 | | DLBWP.1.1 |
| | Config 2,5 | | |
| | Config 3,6 | | |
| PDSCH Reference measurement channel | Config 1,4 | | SR.1.1 FDD |
| | Config 2,5 | | SR.1.1 TDD |
| | Config 3,6 | | SR2.1 TDD |
| RMSI CORESET parameters | Config 1,4 | | CR.1.1 FDD |
| | Config 2,5 | | CR.1.1 TDD |
| | Config 3,6 | | CR2.1 TDD |
| Dedicated CORESET parameters | Config 1,4 | | CCR.1.1 FDD |
| | Config 2,5 | | CCR.1.1 TDD |
| | Config 3,6 | | CCR.2.1 TDD |
| OCNG Patterns | | | OP.1 |
| SSB Configuration | Config 1,2,4,5 | | SSB.1 FR1 |
| | Config 3,6 | | SSB.2 FR1 |
| SMTC Configuration | | | SMTC.1 |
| Antenna Configuration | | | 1x2 |
| Propagation Condition | | | AWGN |
| EPRE ratio of PSS to SSS | | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | |
| EPRE ratio of PDSCH to PDSCH | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| $N_{oc}$ Note 2 | | dBm/15 kHz | [-104] |
| SS-RSRP Note 3 | | dBm/15 kHz | [-87] |
| $\hat{E}_s/I_{ot}$ | | dB | 17 |
| $\hat{E}_s/N_{oc}$ | | dB | 17 |
| Io Note3 | Config 1,2,4,5 | dBm/ 9.36MHz | TBD |
| | Config 3,6 | dBm/ 38.16MHz | TBD |

| | |
|---|---|
| Note 1: | OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. |
| Note 2: | Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. |
| Note 3 | SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |
| Note 4: | Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in TS 38.213 [3] section 12. |

##### A.6.5.6.2.2.2 Test Requirements

During T1, the UE shall start to send the ACK for PCell in a slot (*i+X+k1*).

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, if there are no uplink resources for reporting the ACK in a slot (*i+X+k1*), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

*Editor's note: FFS value of X, k1 for type 1 and type 2 UE.*

# A.6.6 Measurement procedure

## A.6.6.1 Intra-frequency Measurements

### A.6.6.1.1 SA event triggered reporting tests without gap under non-DRX

#### A.6.6.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

#### A.6.6.1.1.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell and neighbour cell are given in Table A.6.6.1.1.1-1 and A.6.6.1.1.1-2 below. In the measurement control information a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

**Table A.6.6.1.1.1.2-1: Supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

**Table A.6.6.1.1.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FR1**

| Parameter | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|
| Active cell | | 1, 2, 3 | Cell 1 | |
| Neighbour cell | | 1, 2, 3 | Cell 2 | Cell to be identified. |
| RF Channel Number | | 1, 2, 3 | 1: Cell 1 and Cell 2 | |
| SSB configuration | | 1 | SSB.1 FR1 | |
| | | 2 | SSB.1 FR1 | |
| | | 3 | SSB.2 FR1 | |
| SMTC configuration | | 1 | SMTC pattern 2 | |
| | | 2 | SMTC pattern 1 | |
| | | 3 | SMTC pattern 1 | |
| A3-Offset | dB | 1, 2, 3 | -4.5 | |
| CP length | | 1, 2, 3 | Normal | |
| Hysteresis | dB | 1, 2, 3 | 0 | |
| Time To Trigger | s | 1, 2, 3 | 0 | |
| Filter coefficient | | 1, 2, 3 | 0 | L3 filtering is not used |
| DRX | | 1, 2, 3 | | OFF |
| Time offset between PCell and PSCell | | 1, 2, 3 | 3 μs | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | 1 | 3 ms | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| | | 2 | 3 μs | Synchronous cells |
| | | 3 | 3 μs | Synchronous cells |
| T1 | s | 1, 2, 3 | 5 | |
| T2 | s | 1, 2, 3 | 5 | |

**Table A.6.6.1.1.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FR1**

| Parameter | Unit | Test configuration | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1 | TDDConf.3.1 | | TDDConf.3.1 | |
| | | 2 | N/A | | N/A | |
| | | 3 | TDDConf.3.1 | | TDDConf.3.1 | |
| PDSCH RMC configuration | | 1 | SR.1.1 FDD | | N/A | |
| | | 2 | SR.1.1 TDD | | | |
| | | 3 | SR.2.1 TDD | | | |
| RMSI CORESET RMC configuration | | 1 | CR.1.1 FDD | | CR.1.1 FDD | |
| | | 2 | CR.1.1 TDD | | CR.1.1 TDD | |
| | | 3 | CR.2.1 TDD | | CR.2.1 TDD | |
| Dedicated CORESET RMC configuration | | 1 | CCR.1.1 FDD | | CCR.1.1 FDD | |
| | | 2 | CCR.1.1 TDD | | CCR.1.1 TDD | |
| | | 3 | CCR.2.1 TDD | | CCR.2.1 TDD | |
| OCNG Patterns | | 1, 2, 3 | OP.1 | | OP.1 | |
| Intial BWP configuration | | 1, 2, 3 | DLBWP.0 ULBWP.0 | | DLBWP.0 ULBWP.0 | |
| Active DL BWP configuration | | 1, 2, 3 | DLBWP.1 | | DLBWP.1 | |
| Active UL BWP configuration | | 1, 2, 3 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1, 2, 3 | SSB | | SSB | |
| $N_{oc}$ Note 2 | dBm/SCS | 1 | -98 | | | |
| | | 2 | -98 | | | |
| | | 3 | -95 | | | |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1 | -98 | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1 | 4 | -1.46 | -Infinity | -1.46 |
| | | 2 | | | | |
| | | 3 | | | | |
| $\hat{E}_s/N_{oc}$ | dB | 1 | 4 | 4 | -Infinity | 4 |
| | | 2 | | | | |
| | | 3 | | | | |
| SS-RSRP Note 3 | dBm/SCS KHz | 1 | -94 | -94 | -Infinity | -94 |
| | | 2 | -94 | -94 | -Infinity | -94 |
| | | 3 | -91 | -91 | -Infinity | -91 |
| Io | dBm/9.36 MHz | 1 | -64.60 | -62.25 | -Infinity | -62.25 |
| | dBm/9.36 MHz | 2 | -64.60 | -62.25 | -Infinity | -62.25 |
| | dBm/38.16 MHz | 3 | -58.50 | -56.16 | -Infinity | -56.16 |
| Propagation Condition | | 1, 2, 3 | AWGN | | | |

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.

Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

## A.6.6.1.1.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [800] ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.6.6.1.2 SA event triggered reporting tests without gap under DRX

#### A.6.6.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

#### A.6.6.1.2.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in Table A.6.6.1.2.1-1, A.6.6.1.2.1-2, A.6.6.1.2.1-3 and A.6.6.1.2.1-4 below. In the measurement control information a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

**Table A.6.6.1.2.2-1: Supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

**Table A.6.6.1.2.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 with DRX**

| Parameter | Unit | Test configuration | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active cell | | 1, 2, 3 | Cell 1 | | |
| Neighbour cell | | 1, 2, 3 | Cell 2 | | Cell to be identified. |
| RF Channel Number | | 1, 2, 3 | 1: Cell 1 and Cell 2 | | |
| SSB configuration | | 1 | SSB.1 FR1 | | |
| | | 2 | SSB.1 FR1 | | |
| | | 3 | SSB.2 FR1 | | |
| SMTC configuration | | 1 | SMTC pattern 2 | | |
| | | 2 | SMTC pattern 1 | | |
| | | 3 | SMTC pattern 1 | | |
| A3-Offset | dB | 1, 2, 3 | -4.5 | | |
| CP length | | 1, 2, 3 | Normal | | |
| Hysteresis | dB | 1, 2, 3 | 0 | | |
| Time To Trigger | s | 1, 2, 3 | 0 | | |
| Filter coefficient | | 1, 2, 3 | 0 | | L3 filtering is not used |
| DRX | ms | 1, 2, 3 | 40 | 640 | |
| Time offset between PCell and PSCell | | 1, 2, 3 | 3 μs | | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | 1 | 3 μs | | Synchronous cells |
| | | 2 | 3 ms | | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| | | 3 | 3 μs | | Synchronous cells |
| T1 | s | 1, 2, 3 | 5 | | |
| T2 | s | 1, 2, 3 | 5 | 10 | |

**Table A.6.6.1.2.1-2: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 with DRX**

| Parameter | Unit | Test configuration | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1 | TDDConf.3.1 | | TDDConf.3.1 | |
| | | 2 | N/A | | N/A | |
| | | 3 | TDDConf.3.1 | | TDDConf.3.1 | |
| PDSCH RMC configuration | | 1 | SR.1.1 FDD | | N/A | |
| | | 2 | SR.1.1 TDD | | | |
| | | 3 | SR.2.1 TDD | | | |
| RMSI CORESET RMC configuration | | 1 | CR.1.1 FDD | | CR.1.1 FDD | |
| | | 2 | CR.1.1 TDD | | CR.1.1 TDD | |
| | | 3 | CR.2.1 TDD | | CR.2.1 TDD | |
| Dedicated CORESET RMC configuration | | 1 | CCR.1.1 FDD | | CCR.1.1 FDD | |
| | | 2 | CCR.1.1 TDD | | CCR.1.1 TDD | |
| | | 3 | CCR.2.1 TDD | | CCR.2.1 TDD | |
| OCNG Patterns | | 1, 2, 3 | OP.1 | | OP.1 | |
| Intial BWP configuration | | 1, 2, 3 | DLBWP.0<br>ULBWP.0 | | DLBWP.0<br>ULBWP.0 | |
| Active DL BWP configuration | | 1, 2, 3 | DLBWP.1 | | DLBWP.1 | |
| Active UL BWP configuration | | 1, 2, 3 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1, 2, 3 | SSB | | SSB | |
| $N_{oc}$ Note 2 | dBm/SCS | 1 | -98 | | | |
| | | 2 | -98 | | | |
| | | 3 | -95 | | | |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1 | -98 | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1 | 4 | -1.46 | -Infinity | -1.46 |
| | | 2 | | | | |
| | | 3 | | | | |
| $\hat{E}_s/N_{oc}$ | dB | 1 | 4 | 4 | -Infinity | 4 |
| | | 2 | | | | |
| | | 3 | | | | |
| SS-RSRP Note 3 | dBm/SCS KHz | 1 | -94 | -94 | -Infinity | -94 |
| | | 2 | -94 | -94 | -Infinity | -94 |
| | | 3 | -91 | -91 | -Infinity | -91 |
| Io | dBm/9.36 MHz | 1 | -64.60 | -62.25 | -Infinity | -62.25 |
| | dBm/9.36 MHz | 2 | -64.60 | -62.25 | -Infinity | -62.25 |
| | dBm/38.16 MHz | 3 | -58.50 | -56.16 | -Infinity | -56.16 |
| Propagation Condition | | 1, 2, 3 | AWGN | | | |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | |

**Table A.6.6.1.2.1-4: DRX-Configuration for SA intra-frequency event triggered reporting with gaps for PCell in FR1**

| Field | Test1 | Test2 | Comment |
|---|---|---|---|
| | Value | Value | |
| onDurationTimer | psf1 | psf1 | As specified in clause 6.3.2 in TS 38.331 [2] |
| drx-InactivityTimer | psf1 | psf1 | |
| drx-RetransmissionTimer | psf1 | psf1 | |
| longDRX-CycleStartOffset | Sf40 | Sf640 | |
| shortDRX | disable | disable | |

**Table A.6.6.1.2.1-5: *TimeAlignmentTimer* -Configuration for SA intra-frequency event triggered reporting with gaps for PCell in FR1**

| Field | Test1 | Test2 | Comment |
|---|---|---|---|
| | Value | Value | |
| TimeAlignmentTimer | sf500 | sf500 | As specified in clause 6.3.2 in TS 38.331 [2] |

### A.6.6.1.2.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [920] ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [6400] ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

## A.6.6.1.3 SA event triggered reporting tests with per-UE gaps under non-DRX

### A.6.6.1.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

### A.6.6.1.3.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in Table A.6.6.1.3.1-1 and A.6.6.1.3.1-2 below. In the measurement control information a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

**Table A.6.6.1.3.2-1: Supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

**Table A.6.6.1.3.2-2: General test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1**

| Parameter | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|
| Active cell | | 1, 2, 3 | Cell 1 | |
| Neighbour cell | | 1, 2, 3 | Cell 2 | Cell to be identified. |
| RF Channel Number | | 1, 2, 3 | 1: Cell 1 and Cell 2 | |
| Measurement gap type | | 1, 2, 3 | Per-UE gaps | |
| Measurement gap repitition periodicity | ms | 1, 2, 3 | 40 | |
| Measurement gap length | ms | 1, 2, 3 | 6 | |
| Measurement gap offset | ms | 1, 2, 3 | 39 | |
| SSB configuration | | 1 | SSB.1 FR1 | |
| | | 2 | SSB.1 FR1 | |
| | | 3 | SSB.2 FR1 | |
| SMTC configuration | | 1 | SMTC pattern 2 | |
| | | 2 | SMTC pattern 1 | |
| | | 3 | SMTC pattern 1 | |
| CSI-RS parameters | | 1 | TBD | |
| | | 2 | TBD | |
| | | 3 | TBD | |
| A3-Offset | dB | 1, 2, 3 | -4.5 | |
| CP length | | 1, 2, 3 | Normal | |
| Hysteresis | dB | 1, 2, 3 | 0 | |
| Time To Trigger | s | 1, 2, 3 | 0 | |
| Filter coefficient | | 1, 2, 3 | 0 | L3 filtering is not used |
| DRX | ms | 1, 2, 3 | | OFF |
| Time offset between PCell and PSCell | | 1, 2, 3 | 3 μs | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | 1 | 3 ms | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| | | 2 | 3 μs | Synchronous cells |
| | | 3 | 3 μs | Synchronous cells |
| T1 | s | 1, 2, 3 | 5 | |
| T2 | s | 1, 2, 3 | 5 | |

**Table A.6.6.1.3.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1**

| Parameter | Unit | Test configuration | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1 | TDDConf.3.1 | | TDDConf.3.1 | |
| | | 2 | N/A | | N/A | |
| | | 3 | TDDConf.3.1 | | TDDConf.3.1 | |
| PDSCH RMC configuration | | 1 | SR.1.1 FDD | | N/A | |
| | | 2 | SR.1.1 TDD | | | |
| | | 3 | SR.2.1 TDD | | | |
| RMSI CORESET RMC configuration | | 1 | CR.1.1 FDD | | CR.1.1 FDD | |
| | | 2 | CR.1.1 TDD | | CR.1.1 TDD | |
| | | 3 | CR.2.1 TDD | | CR.2.1 TDD | |
| Dedicated CORESET RMC configuration | | 1 | CCR.1.1 FDD | | CCR.1.1 FDD | |
| | | 2 | CCR.1.1 TDD | | CCR.1.1 TDD | |
| | | 3 | CCR.2.1 TDD | | CCR.2.1 TDD | |
| OCNG Patterns | | 1, 2, 3 | OP.1 | | OP.1 | |
| Intial BWP configuration | | 1, 2, 3 | DLBWP.0 ULBWP.0 | | DLBWP.0 ULBWP.0 | |
| Active DL BWP configuration | | 1, 2, 3 | DLBWP.2 | | DLBWP.1 | |
| Active UL BWP configuration | | 1, 2, 3 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1, 2, 3 | CSI-RS | | SSB | |
| $N_{oc}$ Note 2 | dBm/SCS | 1 | -98 | | | |
| | | 2 | -98 | | | |
| | | 3 | -95 | | | |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1 | -98 | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1 | 4 | -1.46 | -Infinity | -1.46 |
| | | 2 | | | | |
| | | 3 | | | | |
| $\hat{E}_s/N_{oc}$ | dB | 1 | 4 | 4 | -Infinity | 4 |
| | | 2 | | | | |
| | | 3 | | | | |
| SS-RSRP Note 3 | dBm/SCS KHz | 1 | -94 | -94 | -Infinity | -94 |
| | | 2 | -94 | -94 | -Infinity | -94 |
| | | 3 | -91 | -91 | -Infinity | -91 |
| Io | dBm/9.36 MHz | 1 | -64.60 | -62.25 | -Infinity | -62.25 |
| | dBm/9.36 MHz | 2 | -64.60 | -62.25 | -Infinity | -62.25 |
| | dBm/38.16 MHz | 3 | -58.50 | -56.16 | -Infinity | -56.16 |
| Propagation Condition | | 1, 2, 3 | AWGN | | | |

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.

Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

### A.6.6.1.3.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [800] ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

#### A.6.6.1.4 SA event triggered reporting tests with per-UE gaps under DRX

##### A.6.6.1.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

##### A.6.6.1.4.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in Table A.6.6.1.4.1-1, A.6.6.1.4.1-2, A.6.6.1.4.1-3 and A.6.6.1.4.1-4 below. In the measurement control information a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

**Table A.6.6.1.4.2-1: Supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

**Table A.6.6.1.4.2-2: General test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1 with DRX**

| Parameter | Unit | Test configuration | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active cell | | 1, 2, 3 | Cell 1 | | |
| Neighbour cell | | 1, 2, 3 | Cell 2 | | Cell to be identified. |
| RF Channel Number | | 1, 2, 3 | 1: Cell 1 and Cell 2 | | |
| Measurement gap type | | 1, 2, 3 | Per-UE gaps | | |
| Measurement gap repitition periodicity | ms | 1, 2, 3 | 40 | | |
| Measurement gap length | ms | 1, 2, 3 | 6 | | |
| Measurement gap offset | ms | 1, 2, 3 | 39 | | |
| SSB configuration | | 1 | SSB.1 FR1 | | |
| | | 2 | SSB.1 FR1 | | |
| | | 3 | SSB.2 FR1 | | |
| SMTC configuration | | 1 | SMTC pattern 2 | | |
| | | 2 | SMTC pattern 1 | | |
| | | 3 | SMTC pattern 1 | | |
| CSI-RS parameters | | 1 | TBD | | |
| | | 2 | TBD | | |
| | | 3 | TBD | | |
| A3-Offset | dB | 1, 2, 3 | -4.5 | | |
| CP length | | 1, 2, 3 | Normal | | |
| Hysteresis | dB | 1, 2, 3 | 0 | | |
| Time To Trigger | s | 1, 2, 3 | 0 | | |
| Filter coefficient | | 1, 2, 3 | 0 | | L3 filtering is not used |
| DRX | ms | 1, 2, 3 | 40 | 640 | |
| Time offset between PCell and PSCell | | 1, 2, 3 | 3 μs | | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | 1 | 3 ms | | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| | | 2 | 3 μs | | Synchronous cells |
| | | 3 | 3 μs | | Synchronous cells |
| T1 | s | 1, 2, 3 | 5 | | |
| T2 | s | 1, 2, 3 | 5 | 10 | |

**Table A.6.6.1.4.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1 with DRX**

| Parameter | Unit | Test configuration | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1 | TDDConf.3.1 | | TDDConf.3.1 | |
| | | 2 | N/A | | N/A | |
| | | 3 | TDDConf.3.1 | | TDDConf.3.1 | |
| PDSCH RMC configuration | | 1 | SR.1.1 FDD | | N/A | |
| | | 2 | SR.1.1 TDD | | | |
| | | 3 | SR.2.1 TDD | | | |
| RMSI CORESET RMC configuration | | 1 | CR.1.1 FDD | | CR.1.1 FDD | |
| | | 2 | CR.1.1 TDD | | CR.1.1 TDD | |
| | | 3 | CR.2.1 TDD | | CR.2.1 TDD | |
| Dedicated CORESET RMC configuration | | 1 | CCR.1.1 FDD | | CCR.1.1 FDD | |
| | | 2 | CCR.1.1 TDD | | CCR.1.1 TDD | |
| | | 3 | CCR.2.1 TDD | | CCR.2.1 TDD | |
| OCNG Patterns | | 1, 2, 3 | OP.1 | | OP.1 | |
| Intial BWP configuration | | 1, 2, 3 | DLBWP.0<br>ULBWP.0 | | DLBWP.0<br>ULBWP.0 | |
| Active DL BWP configuration | | 1, 2, 3 | DLBWP.2 | | DLBWP.1 | |
| Active UL BWP configuration | | 1, 2, 3 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1, 2, 3 | CSI-RS | | SSB | |
| $N_{oc}$ Note 2 | dBm/SCS | 1 | -98 | | | |
| | | 2 | -98 | | | |
| | | 3 | -95 | | | |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1 | -98 | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1 | 4 | -1.46 | -Infinity | -1.46 |
| | | 2 | | | | |
| | | 3 | | | | |
| $\hat{E}_s/N_{oc}$ | dB | 1 | 4 | 4 | -Infinity | 4 |
| | | 2 | | | | |
| | | 3 | | | | |
| SS-RSRP Note 3 | dBm/SCS KHz | 1 | -94 | -94 | -Infinity | -94 |
| | | 2 | -94 | -94 | -Infinity | -94 |
| | | 3 | -91 | -91 | -Infinity | -91 |
| Io | dBm/9.36 MHz | 1 | -64.60 | -62.25 | -Infinity | -62.25 |
| | dBm/9.36 MHz | 2 | -64.60 | -62.25 | -Infinity | -62.25 |
| | dBm/38.16 MHz | 3 | -58.50 | -56.16 | -Infinity | -56.16 |
| Propagation Condition | | 1, 2, 3 | AWGN | | | |

Note 1: Table A.6.6.1.4.2-1The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 2: Table A.6.6.1.4.2-1Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.

Note 3: Table A.6.6.1.4.2-1SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

**Table A.6.6.1.4.2-4: DRX-Configuration for SA intra-frequency event triggered reporting with gaps for TDD PCell in FR1**

| Field | Test1 | Test2 | Comment |
|---|---|---|---|
| | Value | Value | |
| onDurationTimer | psf1 | psf1 | As specified in clause 6.3.2 in TS 38.331 [2] |
| drx-InactivityTimer | psf1 | psf1 | |
| drx-RetransmissionTimer | psf1 | psf1 | |
| longDRX-CycleStartOffset | Sf40 | Sf640 | |
| shortDRX | disable | disable | |

**Table A.6.6.1.4.2-5: *TimeAlignmentTimer* -Configuration for SA intra-frequency event triggered reporting with gaps for TDD PCell in FR1**

| Field | Test1 | Test2 | Comment |
|---|---|---|---|
| | Value | Value | |
| TimeAlignmentTimer | sf500 | sf500 | As specified in clause 6.3.2 in TS 38.331 [2] |

### A.6.6.1.4.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [920] ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [6400] ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

## A.6.6.1.5 SA event triggered reporting tests without gap under non-DRX with SSB index reading

### A.6.6.1.5.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the FDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

### A.6.6.1.5.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for FDD PCell and neighbour cell are given in Table A.6.6.1.5.1-1 and A.6.6.1.5.1-2 below. In the measurement control information a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

**Table A.6.6.1.5.2-1: Supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

**Table A.6.6.1.5.2-2 General test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR1 with SSB index reading**

| Parameter | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|
| Active cell | | 1 | Cell 1 | |
| Neighbour cell | | 1 | Cell 2 | Cell to be identified. |
| RF Channel Number | | 1 | 1: Cell 1 and Cell 2 | |
| SSB configuration | | 1 | SSB.1 FR1 | |
| SMTC configuration | | 1 | SMTC pattern 2 | |
| A3-Offset | dB | 1 | -4.5 | |
| CP length | | 1 | Normal | |
| Hysteresis | dB | 1 | 0 | |
| Time To Trigger | s | 1 | 0 | |
| Filter coefficient | | 1 | 0 | L3 filtering is not used |
| DRX | ms | 1 | | OFF |
| Time offset between PCell and PSCell | | 1 | 3 μs | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | 1 | 3 ms | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| T1 | s | 1 | 5 | |
| T2 | s | 1 | 5 | |

**Table A.6.6.1.5.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR1 with SSB index reading**

| Parameter | Unit | Test configuration | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1 | N/A | | N/A | |
| PDSCH RMC configuration | | 1 | SR.1.1 FDD | | N/A | |
| RMSI CORESET RMC configuration | | 1 | CR.1.1 FDD | | CR.1.1 FDD | |
| Dedicated CORESET RMC configuration | | 1 | CCR.1.1 FDD | | CCR.1.1 FDD | |
| OCNG Patterns | | 1 | OP.1 | | OP.1 | |
| Intial BWP configuration | | 1 | DLBWP.0 ULBWP.0 | | DLBWP.0 ULBWP.0 | |
| Active DL BWP configuration | | 1 | DLBWP.1 | | DLBWP.1 | |
| Active UL BWP configuration | | 1 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1 | SSB | | SSB | |
| $N_{oc}$ Note 2 | dBm/SCS | 1 | -98 | | | |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1 | -98 | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1 | 4 | -1.46 | -Infinity | -1.46 |
| $\hat{E}_s/N_{oc}$ | dB | 1 | 4 | 4 | -Infinity | 4 |
| SS-RSRP Note 3 | dBm/SCS KHz | 1 | -94 | -94 | -Infinity | -94 |
| Io | dBm/9.36 MHz | 1 | -64.60 | -62.25 | -Infinity | -62.25 |
| Propagation Condition | | 1 | AWGN | | | |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | |

### A.6.6.1.5.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [920] ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

## A.6.6.1.6 SA event triggered reporting tests with per-UE gaps under non-DRX with SSB index reading

### A.6.6.1.6.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the FDD intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

### A.6.6.1.6.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for FDD PCell and neighbour cell are given in Table A.6.6.1.6.1-1 and A.6.6.1.6.1-2 below. In the measurement control information a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

**Table A.6.6.1.6.2-1: Supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

**Table A.6.6.1.6.2-2: General test parameters for SA intra-frequency event triggered reporting with gap for FDD PCell in FR1 with SSB index reading**

| Parameter | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|
| Active cell | | 1 | Cell 1 | |
| Neighbour cell | | 1 | Cell 2 | Cell to be identified. |
| RF Channel Number | | 1 | 1: Cell 1 and Cell 2 | |
| Measurement gap type | | 1 | Per-UE gaps | |
| Measurement gap repitition periodicity | ms | 1 | 40 | |
| Measurement gap length | ms | 1 | 6 | |
| Measurement gap offset | ms | 1 | 39 | |
| SSB configuration | | 1 | SSB.1 FR1 | |
| SMTC configuration | | 1 | SMTC pattern 2 | |
| CSI-RS parameters | | 1 | TBD | |
| A3-Offset | dB | 1 | -4.5 | |
| CP length | | 1 | Normal | |
| Hysteresis | dB | 1 | 0 | |
| Time To Trigger | s | 1 | 0 | |
| Filter coefficient | | 1 | 0 | L3 filtering is not used |
| DRX | ms | 1 | | OFF |
| Time offset between PCell and PSCell | | 1 | 3 μs | Synchronous EN-DC |
| Time offset between serving and neighbour cells | | 1 | 3 ms | Asynchronous cells.<br>The timing of Cell 3 is 3ms later than the timing of Cell 2. |
| T1 | s | 1 | 5 | |
| T2 | s | 1 | 5 | |

**Table A.6.6.1.6.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with gap for FDD PCell in FR1 with SSB index reading**

| Parameter | Unit | Test configuration | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1 | N/A | | N/A | |
| PDSCH RMC configuration | | 1 | SR.1.1 FDD | | N/A | |
| RMSI CORESET RMC configuration | | 1 | CR.1.1 FDD | | CR.1.1 FDD | |
| Dedicated CORESET RMC configuration | | 1 | CCR.1.1 FDD | | CCR.1.1 FDD | |
| OCNG Patterns | | 1 | OP.1 | | OP.1 | |
| Intial BWP configuration | | 1 | DLBWP.0 ULBWP.0 | | DLBWP.0 ULBWP.0 | |
| Active DL BWP configuration | | 1 | DLBWP.2 | | DLBWP.1 | |
| Active UL BWP configuration | | 1 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1 | CSI-RS | | SSB | |
| $N_{oc}$ Note 2 | dBm/SCS | 1 | -98 | | | |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1 | -98 | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1 | 4 | -1.46 | -Infinity | -1.46 |
| $\hat{E}_s/N_{oc}$ | dB | 1 | 4 | 4 | -Infinity | 4 |
| SS-RSRP Note 3 | dBm/SCS KHz | 1 | -94 | -94 | -Infinity | -94 |
| Io | dBm/9.36 MHz | 1 | -64.60 | -62.25 | -Infinity | -62.25 |
| Propagation Condition | | 1 | AWGN | | | |

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

#### A.6.6.1.6.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [920] ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

## A.6.6.2 Inter-frequency Measurements

### A.6.6.2.1 SA event triggered reporting tests for FR1 without SSB time index detection when DRX is not used

#### A.6.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in Tables A.6.6.2.1.1-1, A.6.6.2.1.1-2 and A.6.6.2.1.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.6.6.2.1.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #4 as defined in Table A.6.6.2.1.1-2 is provided for UE that supports per-FR gap..

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

**Table A.6.6.2.1.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1**

| Config | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations<br>Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

**Table A.6.6.2.1.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection**

| Parameter | Unit | Test configuration | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| NR RF Channel Number | | Config 1,2,3 | 1, 2 | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1,2,3 | NR cell 1 (Pcell) | | NR Cell 1 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3 | NR cell2 | | NR cell 2 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3 | 0 | 4 | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3 | 39 | 19 | |
| SMTC-SSB parameters | | Config 1 | SSB.1 FR1 | | As specified in clause A.3.10.1 |
| | | Config 2 | SSB.1 FR1 | | As specified in clause A.3.10.1 |
| | | Config 3 | SSB.2 FR1 | | As specified in clause A.3.10.1 |
| A3-Offset | dB | Config 1,2,3 | -6 | | |
| Hysteresis | dB | Config 1,2,3 | 0 | | |
| CP length | | Config 1,2,3 | Normal | | |
| TimeToTrigger | s | Config 1,2,3 | 0 | | |
| Filter coefficient | | Config 1,2,3 | 0 | | L3 filtering is not used |
| DRX | | Config 1,2,3 | OFF | | DRX is not used |
| Time offset between serving and neighbour cells | | Config 1 | 3ms | | Asynchronous cells.<br>The timing of Cell 2 is 3ms later than the timing of Cell 1. |
| | | Config 2,3 | 3µs | | Synchronous cells. |
| T1 | s | Config 1,2,3 | 5 | | |
| T2 | s | Config 1,2,3 | TBD | TBD | |

**Table A.6.6.2.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection**

| Parameter | | Unit | Test configuration | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|---|
| | | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | | Config 1,2,3 | 1 | | 2 | |
| Duplex mode | | | Config 1 | FDD | | | |
| | | | Config 2,3 | TDD | | | |
| TDD configuration | | | Config 1 | Not Applicable | | | |
| | | | Config 2 | TDDConf.1.1 | | | |
| | | | Config 3 | TDDConf.2.1 | | | |
| $BW_{channel}$ | | MHz | Config 1,2 | 10: $N_{RB,c}$ = 52 | | | |
| | | | Config 3 | 40: $N_{RB,c}$ = 106 | | | |
| BWP BW | | MHz | Config 1,2 | 10: $N_{RB,c}$ = 52 | | | |
| | | | Config 3 | 40: $N_{RB,c}$ = 106 | | | |
| BWP configuration | Initial DL BWP | | Config 1, 2, 3 | DLBWP.0.1 | | | |
| | Dedicated DL BWP | | | DLBWP.1.1 | | | |
| | Dedicated UL BWP | | | ULBWP.1.1 | | | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | | Config 1,2,3 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | | Config 1 | SR.1.1 FDD | | - | |
| | | | Config 2 | SR.1.1 TDD | | | |
| | | | Config 3 | SR2.1 TDD | | | |
| CORESET Reference Channel | | | Config 1 | CR.1.1 FDD | | - | |
| | | | Config 2 | CR.1.1 TDD | | | |
| | | | Config 3 | CR2.1 TDD | | | |
| SMTC configuration defined in A.3.11.1 and A.3.11. 2 | | | Config 1 | SMTC.2 | | | |
| | | | Config 2, 3 | SMTC.1 | | | |
| PDSCH/PDCCH subcarrier spacing | | kHz | Config 1,2 | 15 | | | |
| | | | Config 3 | 30 | | | |
| EPRE ratio of PSS to SSS | | | Config 1,2,3 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | |
| $N_{oc}$ Note2 | | dBm/15 kHz | | -98 | | | |
| $N_{oc}$ Note2 | | dBm/SCS | Config 1,2 | -98 | | | |
| | | | Config 3 | -95 | | | |
| SS-RSRP Note 3 | | dBm/SCS | Config 1,2 | -94 | -94 | -Infinity | -91 |
| | | | Config 3 | -91 | -91 | -Infinity | -88 |
| $\hat{E}_s/I_{ot}$ | | dB | Config 1,2,3,4,5,6 | 4 | 4 | -Infinity | 7 |
| $\hat{E}_s/N_{oc}$ | | dB | Config 1,2,3 | 4 | 4 | -Infinity | 7 |
| Io Note3 | | dBm/9.36MHz | Config 1,2 | -67.11 | -67.11 | -Infinity | -65.38 |
| | | dBm/38.16MHz | Config 3 | -62.27 | -62.27 | -Infinity | -61.06 |
| Propagation Condition | | | Config 1,2,3 | AWGN | | | |

| |
|---|
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. |

##### A.6.6.2.1.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2x$TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

#### A.6.6.2.2 SA event triggered reporting tests for FR1 without SSB time index detection when DRX is used

##### A.6.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in Tables A.6.6.2.2.1-1, A.6.6.2.2.1-2 and A.6.6.2.2.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.6.6.2.2.1-2 is provided for UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #4 as defined in Table A.6.6.2.2.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

**Table A.6.6.2.2.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1**

| Config | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations<br>Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

**Table A.6.6.2.2.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection**

| Parameter | Unit | Test configuration | Value | | | | Comment |
|---|---|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | Test 3 | Test 4 | |
| NR RF Channel Number | | Config 1,2,3 | 1, 2 | | | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1,2,3 | NR cell 1 (Pcell) | | | | NR Cell 1 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3 | NR cell2 | | | | NR cell 2 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3 | 0 | | 2 | | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3 | 39 | | 39 | | |
| SMTC-SSB parameters | | Config 1 | SSB.1 FR1 | | | | As specified in clause A.3.10.1 |
| | | Config 2 | SSB.1 FR1 | | | | As specified in clause A.3.10.1 |
| | | Config 3 | SSB.2 FR1 | | | | As specified in clause A.3.10.1 |
| A3-Offset | dB | Config 1,2,3 | -6 | | | | |
| Hysteresis | dB | Config 1,2,3 | 0 | | | | |
| CP length | | Config 1,2,3 | Normal | | | | |
| TimeToTrigger | s | Config 1,2,3 | 0 | | | | |
| Filter coefficient | | Config 1,2,3 | 0 | | | | L3 filtering is not used |
| DRX | | Config 1,2,3 | DRX.1 | DRX.2 | DRX.1 | DRX.2 | DRX is used |
| Time offset between serving and neighbour cells | | Config 1 | 3ms | | | | Asynchronous cells.<br>The timing of Cell 2 is 3ms later than the timing of Cell 1. |
| | | Config 2,3 | 3µs | | | | Synchronous cells. |
| T1 | s | Config 1,2,3 | 5 | | | | |
| T2 | s | Config 1,2,3 | TBD | TBD | TBD | TBD | |

**Table A.6.6.2.2.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection**

| Parameter | | Unit | Test configuration | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|---|
| | | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | | Config 1,2,3 | 1 | | 2 | |
| Duplex mode | | | Config 1 | FDD | | | |
| | | | Config 2,3 | TDD | | | |
| TDD configuration | | | Config 1 | Not Applicable | | | |
| | | | Config 2 | TDDConf.1.1 | | | |
| | | | Config 3 | TDDConf.2.1 | | | |
| $BW_{channel}$ | | MHz | Config 1,2 | 10: $N_{RB,c}$ = 52 | | | |
| | | | Config 3 | 40: $N_{RB,c}$ = 106 | | | |
| BWP BW | | MHz | Config 1,2 | 10: $N_{RB,c}$ = 52 | | | |
| | | | Config 3 | 40: $N_{RB,c}$ = 106 | | | |
| BWP configuration | Initial DL BWP | | Config 1, 2, 3 | DLBWP.0.1 | | | |
| | Dedicated DL BWP | | | DLBWP.1.1 | | | |
| | Dedicated UL BWP | | | ULBWP.1.1 | | | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | | Config 1,2,3 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | | Config 1 | SR.1.1 FDD | | - | |
| | | | Config 2 | SR.1.1 TDD | | | |
| | | | Config 3 | SR2.1 TDD | | | |
| CORESET Reference Channel | | | Config 1 | CR.1.1 FDD | | - | |
| | | | Config 2 | CR.1.1 TDD | | | |
| | | | Config 3 | CR2.1 TDD | | | |
| SMTC configuration defined in A.3.11.1 and A.3.11. 2 | | | Config 1 | SMTC.2 | | | |
| | | | Config 2, 3 | SMTC.1 | | | |
| PDSCH/PDCCH subcarrier spacing | | kHz | Config 1,2 | 15 | | | |
| | | | Config 3 | 30 | | | |
| EPRE ratio of PSS to SSS | | | Config 1,2,3 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | |
| $N_{oc}$ Note2 | | dBm/15 kHz | Config 1,2,3 | -98 | | | |
| $N_{oc}$ Note2 | | dBm/SCS | Config 1,2 | -98 | | | |
| | | | Config 3 | -95 | | | |
| SS-RSRP Note 3 | | dBm/SCS | Config 1,2 | -94 | -94 | -Infinity | -91 |
| | | | Config 3 | -91 | -91 | -Infinity | -88 |
| $\hat{E}_s/I_{ot}$ | | dB | Config 1,2,3,4,5,6 | 4 | 4 | -Infinity | 7 |
| $\hat{E}_s/N_{oc}$ | | dB | Config 1,2,3 | 4 | 4 | -Infinity | 7 |
| Io Note3 | | dBm/9.36MHz | Config 1,2 | -67.11 | -67.11 | -Infinity | -65.38 |
| | | dBm/38.16MHz | Config 3 | -62.27 | -62.27 | -Infinity | -61.06 |

| Propagation Condition | | Config 1,2,3 | AWGN |
|---|---|---|---|
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | |

**Table A.6.6.2.2.1-4: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection**

| Field | Test1&3 | Test2&4 | Comment |
|---|---|---|---|
| | Value | Value | |
| drx-onDurationTimer | ms1 | ms1 | As specified in clause 6.3.2 in TS 38.331 [2] |
| drx-InactivityTimer | ms1 | ms1 | |
| drx-RetransmissionTimerDL | sl1 | sl1 | |
| drx-RetransmissionTimerUL | sl1 | sl1 | |
| drx-LongCycleStartOffset | ms40 | Ms640 | |
| shortDRX | disable | disable | |

**Table A.6.6.2.2.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting without SSB time index detection**

| Field | Value | Comment |
|---|---|---|
| TimeAlignmentTimer | ms500 | As specified in clause 6.3.2 in TS 38.331 [2] |

### A.6.6.2.2.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2 , 3 and 4 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.6.6.2.3 SA event triggered reporting tests for FR1 with SSB time index detection when DRX is not used

#### A.6.6.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in Tables A.6.6.2.3.1-1, A.6.6.2.3.1-2 and A.6.6.2.3.1-3.In test 1 measurement gap pattern configuration # 0 as defined in Table A.6.6.2.3.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #4 as defined in Table A.6.6.2.3.1-2 is provided for UE that supports per-FR gap..

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

**Table A. 6.6.2.3.1-1 SA event triggered reporting tests with SSB index reading for FR1-FR1**

| Config | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations<br>Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

**Table A. 6.6.2.3.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection**

| Parameter | Unit | Test configuration | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| NR RF Channel Number | | Config 1,2,3 | 1, 2 | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1,2,3 | NR cell 1 (Pcell) | | NR Cell 1 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3 | NR cell2 | | NR cell 2 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3 | 0 | 2 | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3 | 39 | 39 | |
| SMTC-SSB parameters | | Config 1 | SSB.1 FR1 | | As specified in clause A.3.10.1 |
| | | Config 2 | SSB.1 FR1 | | As specified in clause A.3.10.1 |
| | | Config 3 | SSB.2 FR1 | | As specified in clause A.3.10.1 |
| A3-Offset | dB | Config 1,2,3 | -6 | | |
| Hysteresis | dB | Config 1,2,3 | 0 | | |
| CP length | | Config 1,2,3 | Normal | | |
| TimeToTrigger | s | Config 1,2,3 | 0 | | |
| Filter coefficient | | Config 1,2,3 | 0 | | L3 filtering is not used |
| DRX | | Config 1,2,3 | OFF | | DRX is not used |
| Time offset between serving and neighbour cells | | Config 1 | 3ms | | Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1. |
| | | Config 2,3 | 3µs | | Synchronous cells. |
| T1 | s | Config 1,2,3 | 5 | | |
| T2 | s | Config 1,2,3 | TBD | TBD | |

**Table A. 6.6.2.3.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection**

| Parameter | | Unit | Test configuration | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|---|
| | | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | | Config 1,2,3 | 1 | | 2 | |
| Duplex mode | | | Config 1 | FDD | | | |
| | | | Config 2,3 | TDD | | | |
| TDD configuration | | | Config 1 | Not Applicable | | | |
| | | | Config 2 | TDDConf.1.1 | | | |
| | | | Config 3 | TDDConf.2.1 | | | |
| $BW_{channel}$ | | MHz | Config 1,2 | 10: $N_{RB,c}$ = 52 | | | |
| | | | Config 3 | 40: $N_{RB,c}$ = 106 | | | |
| BWP BW | | MHz | Config 1,2 | 10: $N_{RB,c}$ = 52 | | | |
| | | | Config 3 | 40: $N_{RB,c}$ = 106 | | | |
| BWP configuration | Initial DL BWP | | Config 1, 2, 3 | DLBWP.0.1 | | | |
| | Dedicated DL BWP | | | DLBWP.1.1 | | | |
| | Dedicated UL BWP | | | ULBWP.1.1 | | | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | | Config 1,2,3 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | | Config 1 | SR.1.1 FDD | | - | |
| | | | Config 2 | SR.1.1 TDD | | | |
| | | | Config 3 | SR2.1 TDD | | | |
| CORESET Reference Channel | | | Config 1 | CR.1.1 FDD | | - | |
| | | | Config 2 | CR.1.1 TDD | | | |
| | | | Config 3 | CR2.1 TDD | | | |
| SMTC configuration defined in A.3.11.1 and A.3.11. 2 | | | Config 1 | SMTC.2 | | | |
| | | | Config 2, 3 | SMTC.1 | | | |
| PDSCH/PDCCH subcarrier spacing | | kHz | Config 1,2 | 15 | | | |
| | | | Config 3 | 30 | | | |
| EPRE ratio of PSS to SSS | | | Config 1,2,3 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | |
| $N_{oc}$ Note2 | | dBm/15 kHz | | -98 | | | |
| $N_{oc}$ Note2 | | dBm/SCS | Config 1,2 | -98 | | | |
| | | | Config 3 | -95 | | | |
| SS-RSRP Note 3 | | dBm/SCS | Config 1,2 | -94 | -94 | -Infinity | -91 |
| | | | Config 3 | -91 | -91 | -Infinity | -88 |
| $\hat{E}_s/I_{ot}$ | | dB | Config 1,2,3,4,5,6 | 4 | 4 | -Infinity | 7 |
| $\hat{E}_s/N_{oc}$ | | dB | Config 1,2,3 | 4 | 4 | -Infinity | 7 |
| Io Note3 | | dBm/9.36MHz | Config 1,2 | -67.11 | -67.11 | -Infinity | -65.38 |
| | | dBm/38.16MHz | Config 3 | -62.27 | -62.27 | -Infinity | -61.06 |
| Propagation Condition | | | Config 1,2,3 | AWGN | | | |

| | |
|---|---|
| Note 1: | OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. |
| Note 2: | Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. |
| Note 3: | SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |
| Note 4: | SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. |

#### A.6.6.2.3.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.6.6.2.4 SA event triggered reporting tests for FR1 with SSB time index detection when DRX is used

#### A.6.6.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in Tables A.6.6.2.4.1-1, A.6.6.2.4.1-2 and A.6.6.2.4.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.6.6.2.4.1-2 is provided for UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #4 as defined in Table A.6.6.2.4.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

**Table A.6.6.2.4.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR1**

| Config | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations<br>Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

**Table A.6.6.2.4.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection**

| Parameter | Unit | Test configuration | Value | | | | Comment |
|---|---|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | Test 3 | Test 4 | |
| NR RF Channel Number | | Config 1,2,3 | 1, 2 | | | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1,2,3 | NR cell 1 (Pcell) | | | | NR Cell 1 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3 | NR cell2 | | | | NR cell 2 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3 | 0 | | 2 | | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3 | 39 | | 39 | | |
| SMTC-SSB parameters | | Config 1 | SSB.1 FR1 | | | | As specified in clause A.3.10.1 |
| | | Config 2 | SSB.1 FR1 | | | | As specified in clause A.3.10.1 |
| | | Config 3 | SSB.2 FR1 | | | | As specified in clause A.3.10.1 |
| A3-Offset | dB | Config 1,2,3 | -6 | | | | |
| Hysteresis | dB | Config 1,2,3 | 0 | | | | |
| CP length | | Config 1,2,3 | Normal | | | | |
| TimeToTrigger | s | Config 1,2,3 | 0 | | | | |
| Filter coefficient | | Config 1,2,3 | 0 | | | | L3 filtering is not used |
| DRX | | Config 1,2,3 | DRX.1 | DRX.2 | DRX.1 | DRX.2 | DRX is used |
| Time offset between serving and neighbour cells | | Config 1 | 3ms | | | | Asynchronous cells.<br>The timing of Cell 2 is 3ms later than the timing of Cell 1. |
| | | Config 2,3 | 3μs | | | | Synchronous cells. |
| T1 | s | Config 1,2,3 | 5 | | | | |
| T2 | s | Config 1,2,3 | TBD | TBD | TBD | TBD | |

**Table A.6.6.2.4.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection**

| Parameter | | Unit | Test configuration | Cell 1 T1 | Cell 1 T2 | Cell 2 T1 | Cell 2 T2 |
|---|---|---|---|---|---|---|---|
| NR RF Channel Number | | | Config 1,2,3 | 1 | | 2 | |
| Duplex mode | | | Config 1 | FDD | | | |
| | | | Config 2,3 | TDD | | | |
| TDD configuration | | | Config 1 | Not Applicable | | | |
| | | | Config 2 | TDDConf.1.1 | | | |
| | | | Config 3 | TDDConf.2.1 | | | |
| $BW_{channel}$ | | MHz | Config 1,2 | 10: $N_{RB,c}$ = 52 | | | |
| | | | Config 3 | 40: $N_{RB,c}$ = 106 | | | |
| BWP BW | | MHz | Config 1,2 | 10: $N_{RB,c}$ = 52 | | | |
| | | | Config 3 | 40: $N_{RB,c}$ = 106 | | | |
| BWP configuration | Initial DL BWP | | Config 1, 2, 3 | DLBWP.0.1 | | | |
| | Dedicated DL BWP | | | DLBWP.1.1 | | | |
| | Dedicated UL BWP | | | ULBWP.1.1 | | | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | | Config 1,2,3 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | | Config 1 | SR.1.1 FDD | | - | |
| | | | Config 2 | SR.1.1 TDD | | | |
| | | | Config 3 | SR2.1 TDD | | | |
| CORESET Reference Channel | | | Config 1 | CR.1.1 FDD | | - | |
| | | | Config 2 | CR.1.1 TDD | | | |
| | | | Config 3 | CR2.1 TDD | | | |
| SMTC configuration defined in A.3.11.1 and A.3.11. 2 | | | Config 1 | SMTC.2 | | | |
| | | | Config 2, 3 | SMTC.1 | | | |
| PDSCH/PDCCH subcarrier spacing | | kHz | Config 1,2 | 15 | | | |
| | | | Config 3 | 30 | | | |
| EPRE ratio of PSS to SSS | | | Config 1,2,3 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | |
| $N_{oc}$ Note2 | | dBm/15 kHz | | -98 | | | |
| $N_{oc}$ Note2 | | dBm/SCS | Config 1,2 | -98 | | | |
| | | | Config 3 | -95 | | | |
| SS-RSRP Note 3 | | dBm/SCS | Config 1,2 | -94 | -94 | -Infinity | -91 |
| | | | Config 3 | -91 | -91 | -Infinity | -88 |
| $\hat{E}_s/I_{ot}$ | | dB | Config 1,2,3,4,5,6 | 4 | 4 | -Infinity | 7 |
| $\hat{E}_s/N_{oc}$ | | dB | Config 1,2,3 | 4 | 4 | -Infinity | 7 |
| Io Note3 | | dBm/9.36MHz | Config 1,2 | -67.11 | -67.11 | -Infinity | -65.38 |
| | | dBm/38.16MHz | Config 3 | -62.27 | -62.27 | -Infinity | -61.06 |
| Propagation Condition | | | Config 1,2,3 | AWGN | | | |

| | |
|---|---|
| Note 1: | OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. |
| Note 2: | Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. |
| Note 3: | SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |
| Note 4: | SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. |

#### A.6.6.2.4.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2 , 3 and 4 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.6.6.2.8 SA event triggered reporting tests for FR2 with SSB time index detection when DRX is used

#### A.6.6.2.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.6.6.2.8.1-1, A.6.6.2.8.1-2, and A.6.6.2.8.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.6.6.2.8.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #2 as defined in Table A.6.6.2.8.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

Supported test configurations are shown in table A.6.6.2.8.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

### Table A.6.6.2.8.1-1 SA event triggered reporting tests with SSB index reading for FR1-FR2

| Config | Description of serving cell | Description of target cell |
|---|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | |
| 3 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | |
| Note: The UE is only required to be tested in one of the supported test configurations | | |

### Table A.6.6.2.8.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

| Parameter | Unit | Test configuration | Value | | | | Comment |
|---|---|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | Test 3 | Test 4 | |
| NR RF Channel Number | | Config 1,2,3 | 1, 2 | | | | Two NR carrier frequencies is used. |
| Active cell | | Config 1,2,3 | NR cell 1 (Pcell) | | | | NR Cell 1 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3 | NR cell 2 | | | | NR cell 2 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3 | 0 | | 13 | | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3 | 39 | | 39 | | |
| SMTC-SSB parameters on NR RF Channel 1 | | Config 1 | TBD | | | | |
| | | Config 2 | TBD | | | | |
| | | Config 3 | TBD | | | | |
| SMTC-SSB parameters on NR RF Channel 2 | | Config 1,2,3 | TBD | | | | |
| A3-Offset | dB | Config 1,2,3 | -6 | | | | |
| Hysteresis | dB | Config 1,2,3 | 0 | | | | |
| CP length | | Config 1,2,3 | Normal | | | | |
| TimeToTrigger | s | Config 1,2,3 | 0 | | | | |
| Filter coefficient | | Config 1,2,3 | 0 | | | | L3 filtering is not used |
| DRX | | Config 1,2,3 | 40 | 640 | 40 | 640 | DRX is used |
| Time offset between serving and neighbour cells | | Config 1 | 3ms | | | | Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1. |
| | | Config 2,3 | 3µs | | | | Synchronous cells. |
| T1 | s | Config 1,2,3 | 5 | | | | |
| T2 | s | Config 1,2,3 | TBD | | TBD | | |

**Table A.6.6.2.8.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection**

<table>
<tr><th rowspan="2">Parameter</th><th rowspan="2">Unit</th><th rowspan="2">Test configuration</th><th colspan="2">Cell 2</th><th colspan="2">Cell 3</th></tr>
<tr><th>T1</th><th>T2</th><th>T1</th><th>T2</th></tr>
<tr><td>NR RF Channel Number</td><td></td><td>Config 1,2,3</td><td colspan="2">1</td><td colspan="2">2</td></tr>
<tr><td rowspan="2">Duplex mode</td><td></td><td>Config 1</td><td colspan="2">FDD</td><td colspan="2">TDD</td></tr>
<tr><td></td><td>Config 2,3</td><td colspan="2">TDD</td><td colspan="2">TDD</td></tr>
<tr><td rowspan="3">$BW_{channel}$</td><td rowspan="3">MHz</td><td>Config 1</td><td colspan="2">10: $N_{RB,c}$ = 52</td><td colspan="2">100: $N_{RB,c}$ = 66</td></tr>
<tr><td>Config 2</td><td colspan="2">10: $N_{RB,c}$ = 52</td><td colspan="2">100: $N_{RB,c}$ = 66</td></tr>
<tr><td>Config 3</td><td colspan="2">40: $N_{RB,c}$ = 106</td><td colspan="2">100: $N_{RB,c}$ = 66</td></tr>
<tr><td rowspan="3">BWP BW</td><td rowspan="3">MHz</td><td>Config 1</td><td colspan="2">10: $N_{RB,c}$ = 52</td><td colspan="2">100: $N_{RB,c}$ = 66</td></tr>
<tr><td>Config 2</td><td colspan="2">10: $N_{RB,c}$ = 52</td><td colspan="2">100: $N_{RB,c}$ = 66</td></tr>
<tr><td>Config 3</td><td colspan="2">40: $N_{RB,c}$ = 106</td><td colspan="2">100: $N_{RB,c}$ = 66</td></tr>
<tr><td>OCNG Patterns defined in A.3.2.1.1 (OP.1)</td><td></td><td>Config 1,2,3</td><td colspan="2">OP.1</td><td colspan="2">OP.1</td></tr>
<tr><td rowspan="3">PDSCH Reference measurement channel</td><td></td><td>Config 1</td><td colspan="2">SR.1.1 FDD</td><td colspan="2" rowspan="3">-</td></tr>
<tr><td></td><td>Config 2</td><td colspan="2">SR.1.1 TDD</td></tr>
<tr><td></td><td>Config 3</td><td colspan="2">SR2.1 TDD</td></tr>
<tr><td rowspan="3">CORESET Reference Channel</td><td></td><td>Config 1</td><td colspan="2">CR.1.1 FDD</td><td colspan="2" rowspan="3">-</td></tr>
<tr><td></td><td>Config 2</td><td colspan="2">CR.1.1 TDD</td></tr>
<tr><td></td><td>Config 3</td><td colspan="2">CR2.1 TDD</td></tr>
<tr><td rowspan="2">SMTC configuration defined in A.3.2.1.1 and A.3.2.1.2</td><td></td><td>Config 1,2</td><td colspan="2">SMTC.1 FR1</td><td colspan="2">SMTC.1 FR2</td></tr>
<tr><td></td><td>Config 3</td><td colspan="2">SMTC.2 FR1</td><td colspan="2">SMTC.1 FR2</td></tr>
<tr><td rowspan="2">PDSCH/PDCCH subcarrier spacing</td><td rowspan="2">kHz</td><td>Config 1,2</td><td colspan="2">15</td><td colspan="2">120</td></tr>
<tr><td>Config 3</td><td colspan="2">30</td><td colspan="2">120</td></tr>
<tr><td>EPRE ratio of PSS to SSS</td><td></td><td rowspan="9">Config 1,2,3</td><td colspan="2" rowspan="9">0</td><td colspan="2" rowspan="9">0</td></tr>
<tr><td>EPRE ratio of PBCH DMRS to SSS</td><td></td></tr>
<tr><td>EPRE ratio of PBCH to PBCH DMRS</td><td></td></tr>
<tr><td>EPRE ratio of PDCCH DMRS to SSS</td><td></td></tr>
<tr><td>EPRE ratio of PDCCH to PDCCH DMRS</td><td></td></tr>
<tr><td>EPRE ratio of PDSCH DMRS to SSS</td><td></td></tr>
<tr><td>EPRE ratio of PDSCH to PDSCH</td><td></td></tr>
<tr><td>EPRE ratio of OCNG DMRS to SSS(Note 1)</td><td></td></tr>
<tr><td>EPRE ratio of OCNG to OCNG DMRS (Note 1)</td><td></td></tr>
<tr><td>UE orientation around TBD axis and TBD axis</td><td>degrees</td><td>Config 1,2,3</td><td colspan="2">NA</td><td colspan="2">TBD</td></tr>
<tr><td>Relative difference in angle of arrival of cell 3 relative to cell 2</td><td>degrees</td><td>Config 1,2,3</td><td colspan="2">NA</td><td>NA</td><td>TBD</td></tr>
<tr><td>$N_{oc}$ Note2</td><td>dBm/15 kHz Note5</td><td>Config 1,2,3</td><td colspan="2">-98</td><td colspan="2">-98</td></tr>
<tr><td rowspan="2">$N_{oc}$ Note2</td><td rowspan="2">dBm/SCS Note4</td><td>Config 1,2</td><td colspan="2">-98</td><td colspan="2">-89</td></tr>
<tr><td>Config 3</td><td colspan="2">-95</td><td colspan="2">-89</td></tr>
<tr><td rowspan="2">SS-RSRP Note 3</td><td rowspan="2">dBm/SCS Note5</td><td>Config 1,2</td><td>-94</td><td>-94</td><td>-Infinity</td><td>-82</td></tr>
<tr><td>Config 3</td><td>-91</td><td>-91</td><td>-Infinity</td><td>-82</td></tr>
<tr><td>$\hat{E}_s/I_{ot}$</td><td>dB</td><td>Config 1,2,3</td><td>4</td><td>4</td><td>-Infinity</td><td>7</td></tr>
<tr><td>$\hat{E}_s/N_{oc}$</td><td>dB</td><td>Config 1,2,3</td><td>4</td><td>4</td><td>-Infinity</td><td>7</td></tr>
<tr><td>Io Note3</td><td>dBm/9.36MHz</td><td>Config 1,2</td><td>-66.7</td><td>-66.7</td><td>-</td><td>-</td></tr>
</table>

| | | | | | | |
|---|---|---|---|---|---|---|
| | dBm/38.16MHz | Config 3 | -61.99 | -61.99 | - | - |
| | dBm/95.04 MHz Note5 | Config 1,2,3 | - | - | -Infinity | -55.5 |
| Propagation Condition | | Config 1,2,3 | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 6: As observed with 0dBi gain antenna at the centre of the quiet zone | | | | | | |

**Table A.6.6.2.8.1-4: DRX-Configuration for SA inter-frequency event triggered reporting with SSB time index detection**

| Field | Test1&3 | Test2&4 | Comment |
|---|---|---|---|
| | Value | Value | |
| drx-onDurationTimer | ms1 | ms1 | As specified in clause 6.3.2 in TS 38.331 |
| drx-InactivityTimer | ms1 | ms1 | |
| drx-RetransmissionTimerDL | sl1 | sl1 | |
| drx-RetransmissionTimerUL | sl1 | sl1 | |
| drx-LongCycleStartOffset | ms40 | Ms640 | |
| shortDRX | disable | disable | |

**Table A.6.6.2.8.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting with SSB time index detection**

| Field | Value | Comment |
|---|---|---|
| TimeAlignmentTimer | ms500 | As specified in clause 6.3.2 in TS 38.331 |
| sr-ConfigIndex | TBD | |

### A.6.6.2.8.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2 , 3 and 4 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

## A.6.6.3 Inter-RAT Measurements

### A.6.6.3.1 SA NR - E-UTRAN event-triggered reporting in non-DRX in FR1

#### A.6.6.3.1.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE makes correct event-triggered reporting of inter-RAT E-UTRAN measurements when operating in standalone (SA) operation with PCell in FR1. This test shall partly verify the cell search and measurement requirements in Clauses 9.4.2 and 9.4.3.

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN inter-RAT neighbour cell. In the measurement control information from the PCell it is indictated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

Supported test configurations are shown in table A.6.6.3.1.1-1. General test parameters are provided in Table A.6.6.3.1.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in Tables A.6.6.3.1.1-3 and A.6.6.3.1.1-4, respectively.

**Table A.6.6.3.1.1-1: Supported test configurations in SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1**

| Configuration | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode, LTE FDD |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode, LTE FDD |
| 3 | NR 30 kHz SSB SCS, 40MHz bandwidth, TDD duplex mode, LTE FDD |
| 4 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode, LTE TDD |
| 5 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode, LTE TDD |
| 6 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode, LTE TDD |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.6.6.3.1.1-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| NR RF Channel Number | | 1 | 1 NR carrier frequency is used in the test |
| LTE RF Channel Number | | 1 | 1 LTE carrier frequency is used in the test |
| Channel Bandwidth | MHz | As specified in Tables A.6.6.3.1.1-2 and A.6.6.3.1.1-3. | |
| Active cell | | Cell 1 | Cell 1 is on RF channel number 1 |
| Neighbour cell | | Cell 2 | Cell 2 is on RF channel number 2 |
| Gap Pattern Id | | 0 | As specified in Clause Table 9.1.2-1. Per-UE gap pattern. |
| NR measurement quantity | | SS-RSRP | Measurement quantity for Cell 1 |
| Inter-RAT E-UTRAN measurement quantity | | RSRP | Measurement quantity for Cell 2 |
| b2-Threshold1 | dBm | Note 1 | SS-RSRP threshold for SS-RSRP measurement on cell1 for event B2 |
| b2-Threshold2EUTRA | dBm | -95 | E-UTRAN RSRP threshold for SS-RSRP measurement on cell1 for event B2 |
| Hysteresis | dB | 0 | |
| TimeToTrigger | s | 0 | |
| Filter coefficient | | 0 | L3 filtering is not used |
| DRX | | OFF | OFF |
| T1 | s | 5 | |
| T2 | s | 5 | |
| Note 1: Values are defined in Table A.6.6.3.1.1-3 | | | |

**Table A.6.6.3.1.1-3: PCell specific test parameters for SA inter-RAT E-UTRA event triggered reporting in non-DRX with PCell in FR1**

| Parameter | | Unit | Configuration | Cell 1 | |
|---|---|---|---|---|---|
| | | | | T1 | T2 |
| RF channel number | | | 1, 2, 3, 4, 5, 6 | 1 | |
| Duplex mode | | | 1, 2, 3 | FDD | |
| | | | 4, 5, 6 | TDD | |
| TDD Configuration | SCS=15 KHz | | 2, 5 | TDDConf.1.1 | |
| | SCS=30 KHz | | 3, 6 | TDDConf.1.2 | |
| $BW_{channel}$ | | MHz | 1, 4 | 10: $N_{RB,c}$ = 52 (FDD) | |
| | | | 2, 5 | 10: $N_{RB,c}$ = 52 (TDD) | |
| | | | 3, 6 | 40: $N_{RB,c}$ = 106 (TDD) | |
| PDSCH reference measurement channel | | | 1, 4 | SR.1.1 FDD | |
| | | | 2, 5 | SR.1.1 TDD | |
| | | | 3, 6 | SR.2.1 TDD | |
| CORSET reference channel | | | 1, 4 | CR.1.1 FDD | |
| | | | 2, 5 | CR.1.1 TDD | |
| | | | 3, 6 | CR.2.1 TDD | |
| OCNG pattern[Note1] | | | 1, 2, 3, 4, 5, 6 | OP.1 | |
| SMTC configuration | | | 1, 2, 3, 4, 5, 6 | SMTC.1 | |
| SSB configuration | | | 1, 2, 4, 5 | SSB.1 FR1 | |
| | | | 3, 6 | SSB.2 FR1 | |
| b2-Threshold1 | | dBm | 1, 2, 4, 5 | -89 | |
| | | | 3, 6 | -86 | |
| EPRE ratio of PSS to SSS | | dB | 1, 2, 3, 4, 5, 6 | 0 | |
| EPRE ratio of PBCH_DMRS to SSS | | | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | | | |
| EPRE ratio of OCNG DMRS to SSS | | | | | |
| EPRE ratio of OCNG to OCNG DMRS | | | | | |
| $N_{oc}$[Note2] | | dBm/15 KHz | 1, 2, 3, 4, 5, 6 | -104 | |
| $N_{oc}$[Note2] | | dBm/SCS | 1, 2, 4, 5 | -104 | |
| | | | 3, 6 | -101 | |
| $\hat{E}_s/N_{oc}$ | | dB | 1, 2, 3, 4, 5, 6 | 17 | 7 |
| $\hat{E}_s/I_{ot}$[Note3] | | dB | 1, 2, 3, 4, 5, 6 | 17 | 7 |
| SS-RSRP[Note3] | | dBm/SCS | 1, 2, 4, 5 | -87 | -97 |
| | | | 3, 6 | -84 | -94 |
| SSB_RP[Note3] | | dBm/SCS | 1, 2, 4, 5 | -87 | -97 |
| | | | 3, 6 | -84 | -94 |
| Io[Note3] | | dBm/9.36 MHz | 1, 2, 4, 5 | -58.96 | -68.26 |
| | | dBm/38.16 MHz | 3, 6 | -52.87 | -62.17 |
| Propagation condition | | | 1, 2, 3, 4, 5, 6 | ETU70 | |
| Antenna Configuration and Correlation Matrix | | | 1, 2, 3, 4, 5, 6 | 1x2 Low | |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

**Table A.6.6.3.1.1-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1**

| Parameter | Unit | Configuration | Cell 2 | |
|---|---|---|---|---|
| | | | T1 | T2 |
| RF channel number | | 1, 2, 3, 4, 5, 6 | 1 | |
| Duplex mode | | 1, 2, 3 | FDD | |
| | | 4, 5, 6 | TDD | |
| TDD special subframe configuration[Note1] | | 4, 5, 6 | 6 | |
| TDD uplink-downlink configuration[Note1] | | 4, 5, 6 | 1 | |
| $BW_{channel}$ | MHz | 1, 2, 3, 4, 5, 6 | 5MHz: $N_{RB,c}$ = 25<br>10MHz: $N_{RB,c}$ = 50<br>20MHz: $N_{RB,c}$ = 100 | |
| PDSCH parameters:<br>DL Reference Measurement Channel[Note2] | | 1, 2, 3 | 5MHz: R.7 FDD<br>10MHz: R.3 FDD<br>20MHz: R.6 FDD | |
| | | 4, 5, 6 | 5MHz: R.4 TDD<br>10MHz: R.0 TDD<br>20MHz: R.3 TDD | |
| PCFICH/PDCCH/PHICH parameters:<br>DL Reference Measurement Channel[Note2] | | 1, 2, 3 | 5MHz: R.11 FDD<br>10MHz: R.6 FDD<br>20MHz: R.10 FDD | |
| | | 4, 5, 6 | 5MHz: R.11 TDD<br>10MHz: R.6 TDD<br>20MHz: R.10 TDD | |
| OCNG Patterns[Note2] | | 1, 2, 3 | 5MHz: OP.20 FDD<br>10MHz: OP.10 FDD<br>20MHz: OP.17 FDD | |
| | | 4, 5, 6 | 5MHz: OP.9 TDD<br>10MHz: OP.1 TDD<br>20MHz: OP.7 TDD | |
| PBCH_RA | dB | 1, 2, 3, 4, 5, 6 | 0 | |
| PBCH_RB | | | | |
| PSS_RA | | | | |
| SSS_RA | | | | |
| PCFICH_RB | | | | |
| PHICH_RA | | | | |
| PHICH_RB | | | | |
| PDCCH_RA | | | | |
| PDCCH_RB | | | | |
| PDSCH_RA | | | | |
| PDSCH_RB | | | | |
| OCNG_RA[Note3] | | | | |
| OCNG_RB[Note3] | | | | |
| $N_{oc}$[Note4] | dBm/15kHz | 1, 2, 3, 4, 5, 6 | -104 | |
| $\hat{E}_s/N_{oc}$ | dB | 1, 2, 3, 4, 5, 6 | -Infinity | 17 |
| $\hat{E}_s/I_{ot}$[Note5] | dB | 1, 2, 3, 4, 5, 6 | -Infinity | 17 |
| RSRP[Note5] | dBm/15kHz | 1, 2, 3, 4, 5, 6 | -Infinity | -87 |
| SCH_RP[Note5] | dBm/15kHz | 1, 2, 3, 4, 5, 6 | -Infinity | -87 |
| Io[Note5] | dBm/9MHz | 1, 2, 3, 4, 5, 6 | -76.22+10log ($N_{RB,c}$ /50) | -59.13+10log ($N_{RB,c}$ /50) |
| Propagation Condition | | 1, 2, 3, 4, 5, 6 | ETU70 | |
| Antenna Configuration and Correlation Matrix | | 1, 2, 3, 4, 5, 6 | 1x2 Low | |

Note 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211.
Note 2: DL RMCs and OCNG patterns are specified in sections A 3.1 and A 3.2 of TS 36.133 respectively.
Note 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

##### A.6.6.3.1.2 Test Requirements

The UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 3.84s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

# A.6.7 Measurement Performance requirements

## A.6.7.1 SS-RSRP

### A.6.7.1.1 intra-frequency case

#### A.6.7.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 10.1.2.1.1and 10.1.2.1.2 for intra frequency measurements.

#### A.6.7.1.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.6.7.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra frequency measurements are tested by using the parameters in A.6.7.1.1.2-2. In all test cases, Cell 1 is the PCell, and Cell 2 the target cell.

**Table A.6.7.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations**

| Config | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.6.7.1.1.2-2: SS-RSRP Intra frequency test parameters**

| **Parameter** | | **Unit** | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|---|
| | | | Cell 1 | Cell 2 | Cell 1 | Cell 2 | Cell 1 | Cell 2 |
| SSB ARFCN | | | freq1 | | freq1 | | freq1 | |
| Duplex mode | Config 1 | | FDD | | | | | |
| | Config 2,3 | | TDD | | | | | |
| TDD configuration | Config 1 | | Not Applicable | | | | | |
| | Config 2 | | TDDConf.1.1 | | | | | |
| | Config 3 | | TDDConf.2.1 | | | | | |
| $BW_{channel}$ | Config 1 | MHz | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 2 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 3 | | 40: $N_{RB,c}$ = 106 | | | | | |
| BWP BW | Config 1 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 2 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 3 | | 40: $N_{RB,c}$ = 106 | | | | | |
| Downlink initial BWP configuration | | | DLBWP.0 | | | | | |
| Downlink dedicated BWP configuration | | | DLBWP.1 | | | | | |
| Uplink dedicated BWP configuration | | | ULBWP.1 | | | | | |
| DRX Cycle | | ms | Not Applicable | | | | | |
| PDSCH Reference measurement channel | Config 1 | | SR.1.1 FDD | - | SR.1.1 FDD | - | SR.1.1 FDD | - |
| | Config 2 | | SR.1.1 TDD | | SR.1.1 TDD | | SR.1.1 TDD | |
| | Config 3 | | SR2.1 TDD | | SR2.1 TDD | | SR2.1 TDD | |
| RMSI CORESET Reference Channel | Config 1 | | CR.1.1 FDD | - | CR.1.1 FDD | - | CR.1.1 FDD | - |
| | Config 2 | | CR.1.1 TDD | | CR.1.1 TDD | | CR.1.1 TDD | |
| | Config 3 | | CR2.1 TDD | | CR2.1 TDD | | CR2.1 TDD | |
| Control channel RMC | Config 1 | | CCR.1.1 FDD | - | CCR.1.1 FDD | - | CCR.1.1 FDD | - |
| | Config 2 | | CCR.1.1 TDD | | CCR.1.1 TDD | | CCR.1.1 TDD | |
| | Config 3 | | CCR2.1 TDD | | CCR2.1 TDD | | CCR2.1 TDD | |
| SSB configuration | Config 1 | | SSB 1.FR1 | - | SSB 1.FR1 | - | SSB 1.FR1 | - |
| | Config 2 | | SSB 1.FR1 | | SSB 1.FR1 | | SSB 1.FR1 | |
| | Config 3 | | SSB 2.FR1 | | SSB 2.FR1 | | SSB 2.FR1 | |
| SMTC configuration | | | SMTC.1 | | | | | |
| OCNG Patterns | | | OCNG pattern 1 | | | | | |
| PDSCH/PDCCH subcarrier spacing | Config 1,2 | kHz | 15 kHz | | | | | |
| | Config 3 | | 30kHz | | | | | |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $N_{oc}$ Note2 | Config 1,2 | NR_FDD_FR1_A, NR_TDD_FR1_A | dBm/15KhZ | -106 | | -88 | | -116 | |
| | | NR_FDD_FR1_B | | | | | | -115.5 | |
| | | NR_TDD_FR1_C | | | | | | -115 | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | -114.5 | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | -114 | |
| | | NR_FDD_FR1_G | | | | | | -113 | |
| | | NR_FDD_FR1_H | | | | | | -112.5 | |
| | Config 3 | NR_FDD_FR1_A, NR_TDD_FR1_A | | -113 | | -94 | | -116 | |
| | | NR_FDD_FR1_B | | | | | | -115.5 | |
| | | NR_TDD_FR1_C | | | | | | -115 | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | -114.5 | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | -114 | |
| | | NR_FDD_FR1_G | | | | | | -113 | |
| | | NR_FDD_FR1_H | | | | | | -112.5 | |
| $N_{oc}$ Note2 | Config 1,2 | | dBm/SCS | -106 | | -88 | | Same as Noc/15kHz | |
| | Config 3 | NR_FDD_FR1_A, NR_TDD_FR1_A | | -110 | | -91 | | -113 | |
| | | NR_FDD_FR1_B | | | | | | -112.5 | |
| | | NR_TDD_FR1_C | | | | | | -112 | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | -111.5 | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | -111 | |
| | | NR_FDD_FR1_G | | | | | | -110 | |
| | | NR_FDD_FR1_H | | | | | | -109.5 | |
| $\hat{E}_s/I_{ot}$ | | | dB | 2.5 | -6 | 2.5 | -6 | 0.46 | -5.76 |
| $\hat{E}_s/N_{oc}$ | | | dB | 6 | 1 | 6 | 1 | 3 | -1 |
| SS-RSRP Note3 | Config 1,2 | NR_FDD_FR1_A, NR_TDD_FR1_A | dBm/SCS | -100 | -105 | -82 | -87 | -113 | -117 |
| | | NR_FDD_FR1_B | | | | | | -112.5 | -116.5 |
| | | NR_TDD_FR1_C | | | | | | -112 | -116 |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | -111.5 | -115.5 |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | -111 | -115 |
| | | NR_FDD_FR1_G | | | | | | -110 | -114 |
| | | NR_FDD_FR1_H | | | | | | -109.5 | -113.5 |
| | Config 3 | NR_FDD_FR1_A, NR_TDD_FR1_A | | -106 | -109 | -85 | -90 | -110 | -114 |
| | | NR_FDD_FR1_B | | | | | | -109.5 | -113.5 |
| | | NR_TDD_FR1_C | | | | | | 109 | -113 |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | -108.55 | -112.5 |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | -108 | -112 |
| | | NR_FDD_FR1_G | | | | | | -107 | -111 |
| | | NR_FDD_FR1_H | | | | | | -106.5 | -110.5 |
| Io Note3 | Config 1,2 | NR_FDD_FR1_A, NR_TDD_FR1_A | dBm/9.36MHz | -70.09 | | -52.09 | | -82.26 | |
| | | NR_FDD_FR1_B | | | | | | -81.76 | |
| | | NR_TDD_FR1_C | | | | | | -81.26 | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | -80.76 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | -80.26 |
| | | NR_FDD_FR1_G | | | | -79.26 |
| | | NR_FDD_FR1_H | | | | -78.76 |
| | | NR_FDD_FR1_A, NR_TDD_FR1_A | | | | -76.16 |
| | | NR_FDD_FR1_B | | | | -75.66 |
| | | NR_TDD_FR1_C | | | | -75.16 |
| | Config 3 | NR_FDD_FR1_D, NR_TDD_FR1_D | dBm/ 38.16MHz | -70.99 | -51.99 | -74.66 |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | -74.16 |
| | | NR_FDD_FR1_G | | | | -73.16 |
| | | NR_FDD_FR1_H | | | | -72.66 |
| Propagation condition | | | - | AWGN | | |
| Antenna configuration | | | | 1x2 | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | | |

#### A.6.7.1.1.3 Test Requirements

The SS-RSRP measurement accuracy for cell 1 and cell 2 shall fulfil absolute requirement in section 10.1.2.1.1 and relative requirement in section 10.1.2.1.2.

### A.6.7.1.2 SA inter-frequency case measurement accuracy with FR1 serving cell and FR1 target cell

#### A.6.7.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 10.1.4.1.1 and 10.1.4.1.2 for intra frequency measurements with the testing configurations for NR cells in Table A.6.7.1.2.1-1.

**Table A.6.7.1.2.1-1: Applicable NR configurations for FR1 inter-frequency SS-RSRP accuracy test**

| Config | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |

#### A.6.7.1.2.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on a different frequency than the PCell. The test parameters for the Cell 1 and Cell 2 are given in Table A.6.7.1.2.2-1 below. Both absolute and relative accuracy of RSRP intra frequency measurements are tested by using the parameters in Table A.6.7.1.2.2-1. The inter frequency measurements are supported by a measurement gap.

**Table A.6.7.1.2.2-1: SS-RSRP inter-frequency test parameters**

| Parameter | Unit | Test 1 | | Test 2 | |
|---|---|---|---|---|---|
| | | Cell 1 | Cell 2 | Cell 1 | Cell 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SSB ARFCN | | | | freq1 | freq2 | freq1 | freq2 |
| $BW_{channel}$ | | Config 1, 4 | MHz | 10: $N_{RB,c}$ = 52 | | 10: $N_{RB,c}$ = 52 | |
| | | Config 2, 3, 5, 6 | | 40: $N_{RB,c}$ = 106 | | 40: $N_{RB,c}$ = 106 | |
| Gap pattern Id | | | | 0 | | 0 | |
| PDSCH Reference measurement channel | | Config 1, 4 | | SR.1.1 FDD | - | SR.1.1 FDD | - |
| | | Config 2, 5 | | SR.1.1 TDD | | SR.1.1 TDD | |
| | | Config 3, 6 | | SR.2.1 FDD | | SR.2.1 FDD | |
| PDCCH Reference measurement channel | | Config 1, 4 | | CR.1.1 FDD | | CR.1.1 FDD | |
| | | Config 2, 5 | | CR.1.1 TDD | | CR.1.1 TDD | |
| | | Config 3, 6 | | CR.2.1 FDD | | CR.2.1 FDD | |
| OCNG Patterns | | | | OP.1 | OP.1 | OP.1 | OP.1 |
| SMTC configuration | | Config 1, 2, 4, 5 | | SMTC.1 FR1 | | SMTC.1 FR1 | |
| | | Config 3,6 | | SMTC.2 FR1 | | SMTC.2 FR1 | |
| PBCH_RA | | Config 1~6 | dB | 0 | 0 | 0 | 0 |
| PBCH_RB | | | | | | | |
| PSS_RA | | | | | | | |
| SSS_RA | | | | | | | |
| PBCH_DMRS_RA | | | | | | | |
| PBCH_DMRS_RB | | | | | | | |
| PDCCH_RA | | | | | | | |
| PDCCH_RB | | | | | | | |
| PDSCH_RA | | | | | | | |
| PDSCH_RB | | | | | | | |
| OCNG_RA Note1 | | | | | | | |
| OCNG_RB Note1 | | | | | | | |
| $N_{oc}$ Note2 | Config 1~6 | NR_FDD_FR1_A NR_TDD_FR1_A | dBm/15kHz | -94.65 | | $N_{oc}$ for freq2 + 8dB | TBD |
| | | NR_FDD_FR1_B | | | | | TBD |
| | | NR_TDD_FR1_C | | | | | TBD |
| | | NR_FDD_FR1_D NR_TDD_FR1_D | | | | | TBD |
| | | NR_FDD_FR1_E NR_TDD_FR1_E | | | | | TBD |
| | | NR_FDD_FR1_G | | | | | TBD |
| | | NR_FDD_FR1_H | | | | | TBD |
| $N_{oc}$ Note2 | Config 1, 2, 4, 5 | NR_FDD_FR1_A NR_TDD_FR1_A | dBm/SSB SCS | -94.65 | | $N_{oc}$ for freq2 + 8dB | TBD |
| | | NR_FDD_FR1_B | | | | | TBD |
| | | NR_TDD_FR1_C | | | | | TBD |
| | | NR_FDD_FR1_D NR_TDD_FR1_D | | | | | TBD |
| | | NR_FDD_FR1_E NR_TDD_FR1_E | | | | | TBD |
| | | NR_FDD_FR1_G | | | | | TBD |
| | | NR_FDD_FR1_H | | | | | TBD |
| | Config 3, 6 | NR_FDD_FR1_A NR_TDD_FR1_A | | -91.65 | | $N_{oc}$ for freq2 + 8dB | TBD |
| | | NR_FDD_FR1_B | | | | | TBD |
| | | NR_TDD_FR1_C | | | | | TBD |
| | | NR_FDD_FR1_D NR_TDD_FR1_D | | | | | TBD |
| | | NR_FDD_FR1_E NR_TDD_FR1_E | | | | | TBD |
| | | NR_FDD_FR1_G | | | | | TBD |
| | | NR_FDD_FR1_H | | | | | TBD |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $\hat{E}_s/I_{ot}$ | | | dB | 10 | 10 | 13 | -4 |
| SS-RSRP[Note3] | Config 1, 2, 4, 5 | NR_FDD_FR1_A<br>NR_TDD_FR1_A | dBm/SCS | -84.65 | | RSRP for Cell 2 + 25dB | TBD |
| | | NR_FDD_FR1_B | | | | | TBD |
| | | NR_TDD_FR1_C | | | | | TBD |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | TBD |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | TBD |
| | | NR_FDD_FR1_G | | | | | TBD |
| | | NR_FDD_FR1_H | | | | | TBD |
| | Config 3, 6 | NR_FDD_FR1_A<br>NR_TDD_FR1_A | | -81.65 | | RSRP for Cell 2 + 25dB | TBD |
| | | NR_FDD_FR1_B | | | | | TBD |
| | | NR_TDD_FR1_C | | | | | TBD |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | TBD |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | TBD |
| | | NR_FDD_FR1_G | | | | | TBD |
| | | NR_FDD_FR1_H | | | | | TBD |
| Io[Note3] | Config 1, 2, 4, 5 | NR_FDD_FR1_A<br>NR_TDD_FR1_A | dBm/ 9.36MHz | -56.28 | | TBD | |
| | | NR_FDD_FR1_B | | | | TBD | |
| | | NR_TDD_FR1_C | | | | TBD | |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | TBD | |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | TBD | |
| | | NR_FDD_FR1_G | | | | TBD | |
| | | NR_FDD_FR1_H | | | | TBD | |
| | Config 3, 6 | NR_FDD_FR1_A<br>NR_TDD_FR1_A | dBm/ 38.16MHz | -50.19 | | TBD | |
| | | NR_FDD_FR1_B | | | | TBD | |
| | | NR_TDD_FR1_C | | | | TBD | |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | TBD | |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | TBD | |
| | | NR_FDD_FR1_G | | | | TBD | |
| | | NR_FDD_FR1_H | | | | TBD | |
| $\hat{E}_s/N_{oc}$ | | | dB | 10 | 10 | 13 | -4 |
| Propagation condition | | | - | AWGN | | AWGN | |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

#### A.6.7.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil the Absolute requirement in section 10.1.4.1.1 and Relative requirement in section 10.1.4.1.2.

### A.6.7.1.3 SA inter-frequency measurement accuracy with FR1 serving cell and FR2 target cell

#### A.6.7.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 10.1.5.1.1 for inter-frequency measurements with the testing configurations in Table A.6.7.1.3.1-1.

**Table A.6.7.1.3.1-1: Applicable NR configurations for FR1 inter-frequency SS-RSRP accuracy test**

| Config | Description of serving cell | Description of target cell |
|---|---|---|
| 1 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | |
| 3 | LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | |

#### A.6.7.1.3.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on a different frequency than the PCell. The test parameters for the Cell 1 and Cell 2 are given in Table A.6.7.1.3.2-1 and Table A.6.7.1.3.2-2 below. Both absolute and relative accuracy of RSRP intra frequency measurements are tested by using the parameters in Table A.6.7.1.3.2-1 and Table A.6.7.1.3.2-2. The inter frequency measurements are supported by a measurement gap.

**Table A.6.7.1.3.2-1: SS-RSRP inter-frequency test parameters**

| Parameter | Config | Unit | Test 1 | | Test 2 | |
|---|---|---|---|---|---|---|
| | | | Cell 1 | Cell 2 | Cell 1 | Cell 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| SSB ARFCN | 1~3 | | freq1 | freq2 | freq1 | freq2 |
| $BW_{channel}$ | 1 | MHz | 10: $N_{RB,c}$ = 52 | 100: $N_{RB,c}$ = 66 | 10: $N_{RB,c}$ = 52 | 100: $N_{RB,c}$ = 66 |
| | 2 | | 10: $N_{RB,c}$ = 52 | | 10: $N_{RB,c}$ = 52 | |
| | 3 | | 40: $N_{RB,c}$ = 106 | | 40: $N_{RB,c}$ = 106 | |
| Duplex mode | 1 | | FDD | TDD | FDD | TDD |
| | 2 | | TDD | | TDD | |
| | 3 | | TDD | | TDD | |
| TDD configuration | 1 | | N/A | TDDConf. 3.1 | N/A | TDDConf. 3.1 |
| | 2 | | TDDConf. 1.1 | | TDDConf. 1.1 | |
| | 3 | | TDDConf. 2.1 | | TDDConf. 2.1 | |
| PDSCH Reference measurement channel | 1 | | SR.1.1 FDD | - | SR.1.1 FDD | - |
| | 2 | | SR.1.1 TDD | | SR.1.1 TDD | |
| | 3 | | SR.2.1 FDD | | SR.2.1 FDD | |
| RMSI CORESET Reference Channel | 1 | | CR.1.1 FDD | - | CR.1.1 FDD | - |
| | 2 | | CR.1.1 TDD | - | CR.1.1 TDD | - |
| | 3 | | CR.2.1 FDD | - | CR.2.1 FDD | - |
| Dedicated CORESET Reference Channel | 1 | | CCR.1.1 FDD | - | CCR.1.1 FDD | - |
| | 2 | | CCR.1.1 TDD | - | CCR.1.1 TDD | - |
| | 3 | | CCR.2.1 TDD | - | CCR.2.1 TDD | - |
| SSB configuration | 1 | | SSB.1 FR1 | SSB.1 FR2 | SSB.1 FR1 | SSB.1 FR2 |
| | 2 | | SSB.1 FR1 | | SSB.1 FR1 | |
| | 3 | | SSB.2 FR1 | | SSB.2 FR1 | |
| OCNG Patterns | 1~3 | | OP.1 | | OP.1 | |
| DL BWP | 1~3 | | DLBWP.1 | | DLBWP.1 | |
| UL BWP | 1~3 | | ULBWP.1 | | ULBWP.1 | |
| SMTC configuration | 1~3 | | SMTC.1 | | SMTC.1 | |
| EPRE ratio of PSS to SSS | 1~3 | dB | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | | | | | |
| EPRE ratio of OCNG DMRS to SSS Note 1 | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 | | | | | | |
| Propagation condition | 1~3 | - | AWGN | | AWGN | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. | | | | | | |

**Table A.6.7.1.3.2-2: SS-RSRP inter-frequency OTA related test parameters**

| Parameter | | Config | Unit | Test 1 | | Test 2 | |
|---|---|---|---|---|---|---|---|
| | | | | Cell 1 | Cell 2 | Cell 1 | Cell 2 |
| $N_{oc}$ Note2 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1~3 | dBm/15 kHz | TBD | | TBD | TBD |
| | NR_FDD_FR1_B | | | | | | TBD |
| | NR_TDD_FR1_C | | | | | | TBD |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | TBD |
| | NR_FDD_FR1_G | | | | | | TBD |
| | NR_FDD_FR1_H | | | | | | TBD |
| $N_{oc}$ Note2 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2,4,5 | dBm/SSB SCS | TBD | TBD | TBD | TBD |
| | NR_FDD_FR1_B | | | | | | TBD |
| | NR_TDD_FR1_C | | | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | TBD |
| | NR_FDD_FR1_G | | | | | | TBD |
| | NR_FDD_FR1_H | | | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3 | | TBD | | TBD | TBD |
| | NR_FDD_FR1_B | | | | | | TBD |
| | NR_TDD_FR1_C | | | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | TBD |
| | NR_FDD_FR1_G | | | | | | TBD |
| | NR_FDD_FR1_H | | | | | | TBD |
| $\hat{E}_s/I_{ot}$ | | 1~3 | dB | TBD | TBD | TBD | TBD |
| SS-RSRP Note3 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2,4,5 | dBm/SCS | TBD | TBD | TBD | TBD |
| | NR_FDD_FR1_B | | | | | | TBD |
| | NR_TDD_FR1_C | | | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | TBD |
| | NR_FDD_FR1_G | | | | | | TBD |
| | NR_FDD_FR1_H | | | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3 | | TBD | | TBD | TBD |
| | NR_FDD_FR1_B | | | | | | TBD |
| | NR_TDD_FR1_C | | | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | TBD |
| | NR_FDD_FR1_G | | | | | | TBD |
| | NR_FDD_FR1_H | | | | | | TBD |
| Io Note3 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2,4,5 | dBm/9.36MHz | N/A | | TBD | |
| | NR_FDD_FR1_B | | | | | TBD | |
| | NR_TDD_FR1_C | | | | | TBD | |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | TBD | |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | TBD | |
| | NR_FDD_FR1_G | | | | | TBD | |
| | NR_FDD_FR1_H | | | | | TBD | |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3 | dBm/38.16MHz | N/A | | TBD | |
| | NR_FDD_FR1_B | | | | | TBD | |
| | NR_TDD_FR1_C | | | | | TBD | |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | TBD | |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | TBD | |
| | NR_FDD_FR1_G | | | | | TBD | |
| | NR_FDD_FR1_H | | | | | TBD | |
| | NR_TDD_FR2_A | 1~3 | dBm/95.04MHz | N/A | TBD | TBD | |
| | NR_TDD_FR2_B | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | TBD | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | NR_TDD_FR2_Y | | | | | TBD | |
| $\hat{E}_s / N_{oc}$ | | 1~3 | dB | TBD | TBD | TBD | TBD |
| Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | | | |

#### A.6.7.1.3.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 shall fulfil the Absolute requirement in section 10.1.5.1.1.

## A.6.7.2 SS-RSRQ

### A.6.7.2.1 Intra-frequency case

#### A.6.7.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.7.1.1.

#### A.6.7.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in Table A.6.7.2.1.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is test by using the parameters in Table A.6.7.2.1.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

**Table A.6.7.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations**

| Config | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.6.7.2.1.2-2: SS-RSRQ Intra frequency test parameters**

| Parameter | | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|---|
| | | | Cell 1 | Cell 2 | Cell 1 | Cell 2 | Cell 1 | Cell 2 |
| SSB ARFCN | | | freq1 | | freq1 | | freq1 | |
| Duplex mode | Config 1 | | FDD | | | | | |
| | Config 2,3 | | TDD | | | | | |
| TDD configuration | Config 1 | | Not Applicable | | | | | |
| | Config 2 | | TDDConf.1.1 | | | | | |
| | Config 3 | | TDDConf.1.2 | | | | | |
| $BW_{channel}$ | Config 1 | MHz | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 2 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 3 | | 40: $N_{RB,c}$ = 106 | | | | | |
| BWP BW | Config 1 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 2 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 3 | | 40: $N_{RB,c}$ = 106 | | | | | |
| DRx Cycle | | ms | Not Applicable | | | | | |
| PDSCH Reference measurement channel | Config 1 | | SR.1.1 FDD | - | SR.1.1 FDD | - | SR.1.1 FDD | - |
| | Config 2 | | SR.1.1 TDD | | SR.1.1 TDD | | SR.1.1 TDD | |
| | Config 3 | | SR2.1 TDD | | SR2.1 TDD | | SR2.1 TDD | |
| RMSI CORESET Reference Channel | Config 1 | | CR.1.1 FDD | - | CR.1.1 FDD | - | CR.1.1 FDD | |
| | Config 2 | | CR.1.1 TDD | | CR.1.1 TDD | | CR.1.1 TDD | |
| | Config 3 | | CR2.1 TDD | | CR2.1 TDD | | CR2.1 TDD | |
| Dedicated CORESET Reference Channel | Config 1 | | CCR.1.1 FDD | - | CCR.1.1 FDD | - | CCR.1.1 FDD | - |
| | Config 2 | | CCR.1.1 TDD | | CCR.1.1 TDD | | CCR.1.1 TDD | |
| | Config 3 | | CCR2.1 TDD | | CCR2.1 TDD | | CCR2.1 TDD | |
| OCNG Patterns | | | OP. 1 | | | | | |
| SS-RSSI-Measurement | | | Not Applicable | | | | | |
| SMTC configuration | | | SMTC.1 | | | | | |
| SSB configuration | Config 1,2 | | SSB.1 FR1 | | | | | |
| | Config 3 | | SSB.2 FR1 | | | | | |
| PDSCH/PDCCH subcarrier spacing | Config 1,2 | kHz | 15 kHz | | | | | |
| | Config 3 | | 30kHz | | | | | |
| EPRE ratio of PSS to SSS<br>EPRE ratio of PBCH DMRS to SSS<br>EPRE ratio of PBCH to PBCH DMRS<br>EPRE ratio of PDCCH DMRS to SSS<br>EPRE ratio of PDCCH to PDCCH DMRS<br>EPRE ratio of PDSCH DMRS to SSS<br>EPRE ratio of PDSCH to PDSCH<br>EPRE ratio of OCNG DMRS to SSS(Note 1)<br>EPRE ratio of OCNG to OCNG DMRS (Note 1) | | dB | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $N_{oc}$ Note2 | | NR_FDD_FR1_A, NR_TDD_FR1_A | dBm/15kHz | -91 | | [-110.05] | | [-120] | |
| | | NR_FDD_FR1_B | | | | | | [-119.5] | |
| | | NR_TDD_FR1_C | | | | | | [-119] | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | [-118.5] | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | [-118] | |
| | | NR_FDD_FR1_G | | | | | | [-117] | |
| | | NR_FDD_FR1_H | | | | | | [-116.5] | |
| $N_{oc}$ Note2 | Config 1,2 | | dBm/SCS | -91 | | [-110.05] | | Same as Noc for 15kHz | |
| | Config 3 | NR_FDD_FR1_A, NR_TDD_FR1_A | | -88 | | [-107.05] | | [-117] | |
| | | NR_FDD_FR1_B | | | | | | [-116.5] | |
| | | NR_TDD_FR1_C | | | | | | [-116] | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | [-115.5] | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | [-115] | |
| | | NR_FDD_FR1_G | | | | | | [-114] | |
| | | NR_FDD_FR1_H | | | | | | [-113.5] | |
| $\hat{E}_s/I_{ot}$ | | | dB | -1.76 | | -4.7 | | -5..46 | -5.46 |
| $\hat{E}_s/N_{oc}$ | | | dB | 3 | 3 | -2.9 | -2.9 | -4 | -4 |
| SS-RSRP Note3 | Config 1,2 | NR_FDD_FR1_A, NR_TDD_FR1_A | dBm/SCS | -88 | -88 | [-112.95] | [-112.95] | [-124] | [-124] |
| | | NR_FDD_FR1_B | | | | | | [-123.5] | [-123.5] |
| | | NR_TDD_FR1_C | | | | | | [-123] | [-123] |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | [-122.5] | [-122.5] |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | [-122] | [-122] |
| | | NR_FDD_FR1_G | | | | | | [-121] | [-121] |
| | | NR_FDD_FR1_H | | | | | | [-120.5] | [-120.5] |
| | Config 3 | NR_FDD_FR1_A, NR_TDD_FR1_A | | -85 | -85 | [-109.95] | [-109.95] | [-121] | [-121] |
| | | NR_FDD_FR1_B | | | | | | [-120.5] | [-120.5] |
| | | NR_TDD_FR1_C | | | | | | [-120] | [-120] |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | [-119.5] | [-119.5] |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | [-119] | [-119] |
| | | NR_FDD_FR1_G | | | | | | [-118] | [-118] |
| | | NR_FDD_FR1_H | | | | | | [-117.5] | [-117.5] |
| SS-RSRQ Note3 | | NR_FDD_FR1_A, NR_TDD_FR1_A | dB | -14.77 | -14.77 | -16.76 | -16.76 | [-17.34 | [-17.34] |
| | | NR_FDD_FR1_B | | | | | | | |
| | | NR_TDD_FR1_C | | | | | | | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | | |
| | | NR_FDD_FR1_G | | | | | | | |
| | | NR_FDD_FR1_H | | | | | | | |
| Io Note3 | Config 1,2 | NR_FDD_FR1_A, NR_TDD_FR1_A | dBm/9.36MHz | -56 | | [-79] | | [-89.5] | |
| | | NR_FDD_FR1_B | | | | | | [-89] | |
| | | NR_TDD_FR1_C | | | | | | [-88.5] | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | [-88] | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | [-87.5] | |
| | | NR_FDD_FR1_G | | | | | | [-86.5] | |
| | | NR_FDD_FR1_H | | | | | | [-86] | |
| | Config 3 | NR_FDD_FR1_A, NR_TDD_FR1_A | dBm/ 38.16MHz | -50.00 | | [-73] | | [-83.41] | |
| | | NR_FDD_FR1_B | | | | | | [-82.91] | |
| | | NR_TDD_FR1_C | | | | | | [-82.41] | |
| | | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | [-81.91] | |
| | | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | [-81.41] | |
| | | NR_FDD_FR1_G | | | | | | [-80.41] | |
| | | NR_FDD_FR1_H | | | | | | [-79.91] | |
| Propagation condition | | | - | AWGN | AWGN | AWGN | AWGN | AWGN | AWGN |
| Antenna configuration | | | | 1x2 | 1x2 | 1x2 | 1x2 | 1x2 | 1x2 |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: NR operating band groups are as defined in Section 3.5.2.

##### A.6.7.2.1.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in section 10.1.7.1.1.

### A.6.7.2.2 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

##### A.6.7.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.9.1.1 and 10.1.9.1.2.

##### A.6.7.2.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 alnd Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in Table A.6.7.2.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test parameters in Table A.6.7.2.2.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

**Table A.6.7.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations**

| Config | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.6.7.2.2.2-2: SS-RSRQ Inter frequency test parameters**

| Parameter | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|
| | | Cell 1 | Cell 2 | Cell 1 | Cell 2 | Cell 1 | Cell 2 |

| Parameter | | Unit | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SSB ARFCN | | | freq1 | freq2 | freq1 | freq2 | freq1 | freq2 |
| Duplex mode | Config 1 | | FDD | | | | | |
| | Config 2,3 | | TDD | | | | | |
| TDD configuration | Config 1 | | Not Applicable | | | | | |
| | Config 2 | | TDDConf.1.1 | | | | | |
| | Config 3 | | TDDConf.2.1 | | | | | |
| $BW_{channel}$ | Config 1 | MHz | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 2 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 3 | | 40: $N_{RB,c}$ = 106 | | | | | |
| BWP BW | Config 1 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 2 | | 10: $N_{RB,c}$ = 52 | | | | | |
| | Config 3 | | 40: NRB,c = 106 | | | | | |
| DRX Cycle | | ms | Not Applicable | | | | | |
| PDSCH Reference measurement channel | Config 1,4 | | SR.1.1 FDD | - | SR.1.1 FDD | - | SR.1.1 FDD | - |
| | Config 2,5 | | SR.1.1 TDD | | SR.1.1 TDD | | SR.1.1 TDD | |
| | Config 3,6 | | SR2.1 TDD | | SR2.1 TDD | | SR2.1 TDD | |
| RMSI CORESET Reference Channel | Config 1 | | CR.1.1 FDD | - | R.1.1 FDD | - | CR.1.1 FDD | |
| | Config 2 | | CR.1.1 TDD | | CR.1.1 TDD | | CR.1.1 TDD | |
| | Config 3 | | CR2.1 TDD | | CR2.1 TDD | | CR2.1 TDD | |
| Dedicated CORESET Reference Channel | Config 1 | | CCR.1.1 FDD | - | CCR.1.1 FDD | - | CCR.1.1 FDD | - |
| | Config 2 | | CCR.1.1 TDD | | CCR.1.1 TDD | | CCR.1.1 TDD | |
| | Config 3 | | CCR2.1 TDD | | CCR2.1 TDD | | CCR2.1 TDD | |
| OCNG Patterns | | | OCNG pattern 1 | | | | | |
| SMTC configuration | Config 1,2 | | SMTC pattern 1 | | | | | |
| | Config 3 | | SMTC pattern 2 | | | | | |
| SSB configuration | Config 1,2 | | SSB pattern 1 in FR1 | | | | | |
| | Config 3 | | SSB pattern 2 in FR1 | | | | | |
| PDSCH/PDCCH subcarrier spacing | Config 1,2 | kHz | 15 kHz | | | | | |
| | Config 3 | | 30 kHz | | | | | |
| EPRE ratio of PSS to SSS<br>EPRE ratio of PBCH DMRS to SSS<br>EPRE ratio of PBCH to PBCH DMRS<br>EPRE ratio of PDCCH DMRS to SSS<br>EPRE ratio of PDCCH to PDCCH DMRS<br>EPRE ratio of PDSCH DMRS to SSS<br>EPRE ratio of PDSCH to PDSCH<br>EPRE ratio of OCNG DMRS to SSS(Note 1)<br>EPRE ratio of OCNG to OCNG DMRS (Note 1) | | dB | 0 | 0 | 0 | 0 | 0 | 0 |
| $N_{oc}$ Note2 | Config 1,2: NR_FDD_FR1_A, NR_TDD_FR1_A | dBm/15kHz | -80.18 | | TBD | | TBD | |
| | NR_FDD_FR1_B | | | | | | TBD | |
| | NR_TDD_FR1_C | | | | | | TBD | |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | | | TBD | |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | | | TBD | |
| | NR_FDD_FR1_G | | | | | | TBD | |
| | NR_FDD_FR1_H | | | | | | TBD | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $N_{oc}$ Note2 | Config 3 | NR_FDD_FR1_A<br>NR_TDD_FR1_A | dBm/15kHz | -86.27 | | TBD | | TBD | |
| | | NR_FDD_FR1_B | | | | | | TBD | |
| | | NR_TDD_FR1_C | | | | | | TBD | |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | | TBD | |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | | TBD | |
| | | NR_FDD_FR1_G | | | | | | TBD | |
| | | NR_FDD_FR1_H | | | | | | TBD | |
| $N_{oc}$ Note2 | Config 1,2 | NR_FDD_FR1_A<br>NR_TDD_FR1_A | dBm/15kHz | -80.18 | | TBD | | TBD | |
| | | NR_FDD_FR1_B | | | | | | TBD | |
| | | NR_TDD_FR1_C | | | | | | TBD | |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | | TBD | |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | | TBD | |
| | | NR_FDD_FR1_G | | | | | | TBD | |
| | | NR_FDD_FR1_H | | | | | | TBD | |
| | Config 3 | NR_FDD_FR1_A<br>NR_TDD_FR1_A | | -83.27 | | TBD | | TBD | |
| | | NR_FDD_FR1_B | | | | | | TBD | |
| | | NR_TDD_FR1_C | | | | | | TBD | |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | | TBD | |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | | TBD | |
| | | NR_FDD_FR1_G | | | | | | TBD | |
| | | NR_FDD_FR1_H | | | | | | TBD | |
| $\hat{E}_s/I_{ot}$ | | | dB | -1.75 | | TBD | | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | | | dB | -1.75 | | TBD | | TBD | TBD |
| SS-RSRP Note3 | Config 1,2 | NR_FDD_FR1_A<br>NR_TDD_FR1_A | dBm/SCS | -81.93 | -81.93 | TBD | TBD | TBD | TBD |
| | | NR_FDD_FR1_B | | | | | | TBD | TBD |
| | | NR_TDD_FR1_C | | | | | | TBD | TBD |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | | TBD | TBD |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | | TBD | TBD |
| | | NR_FDD_FR1_G | | | | | | TBD | TBD |
| | | NR_FDD_FR1_H | | | | | | TBD | TBD |
| | Config 3 | NR_FDD_FR1_A<br>NR_TDD_FR1_A | | -85.02 | -85.02 | TBD | TBD | TBD | TBD |
| | | NR_FDD_FR1_B | | | | | | TBD | TBD |
| | | NR_TDD_FR1_C | | | | | | TBD | TBD |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | | TBD | TBD |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | | TBD | TBD |
| | | NR_FDD_FR1_G | | | | | | TBD | TBD |
| | | NR_FDD_FR1_H | | | | | | TBD | TBD |
| SS-RSRQ Note3 | | NR_FDD_FR1_A<br>NR_TDD_FR1_A | dB | -14.77 | -14.77 | TBD | TBD | TBD | TBD |
| | | NR_FDD_FR1_B | | | | | | TBD | TBD |
| | | NR_TDD_FR1_C | | | | | | TBD | TBD |
| | | NR_FDD_FR1_D<br>NR_TDD_FR1_D | | | | | | TBD | TBD |
| | | NR_FDD_FR1_E<br>NR_TDD_FR1_E | | | | | | TBD | TBD |
| | | NR_FDD_FR1_G | | | | | | TBD | TBD |
| | | NR_FDD_FR1_H | | | | | | TBD | TBD |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Io[Note3] | Config 1,2 | NR_FDD_FR1_A NR_TDD_FR1_A | dBm/SCS | -50 | | TBD | | TBD | TBD |
| | | NR_FDD_FR1_B | | | | | | TBD | TBD |
| | | NR_TDD_FR1_C | | | | | | TBD | TBD |
| | | NR_FDD_FR1_D NR_TDD_FR1_D | | | | | | TBD | TBD |
| | | NR_FDD_FR1_E NR_TDD_FR1_E | | | | | | TBD | TBD |
| | | NR_FDD_FR1_G | | | | | | TBD | TBD |
| | | NR_FDD_FR1_H | | | | | | TBD | TBD |
| | Config 3 | NR_FDD_FR1_A NR_TDD_FR1_A | | -50 | | TBD | | TBD | TBD |
| | | NR_FDD_FR1_B | | | | | | TBD | TBD |
| | | NR_TDD_FR1_C | | | | | | TBD | TBD |
| | | NR_FDD_FR1_D NR_TDD_FR1_D | | | | | | TBD | TBD |
| | | NR_FDD_FR1_E NR_TDD_FR1_E | | | | | | TBD | TBD |
| | | NR_FDD_FR1_G | | | | | | TBD | TBD |
| | | NR_FDD_FR1_H | | | | | | TBD | TBD |
| Propagation condition | | | - | AWGN | AWGN | AWGN | AWGN | AWGN | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 5: NR operating band groups are as defined in Section 3.5.2. | | | | | | | | | |

##### A.6.7.2.2.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in section 10.1.9.1.1 and 10.1.9.1.2.

### A.6.7.3 SS-SINR

### A.6.7.4 L1-RSRP measurement for beam reporting

#### A.6.7.4.1 SSB based L1-RSRP measurement

##### A.6.7.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 9.5.2 and section 10.1.19.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in Table A.6.7.4.1.1-1.

**Table A.6.7.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test**

| Config | Description |
|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

##### A.6.7.4.1.2 Test parameters

In this set of test cases there one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.6.7.4.1.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in Table A.6.7.4.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0 and 1.

**Table A.6.7.4.1.2-1: FR1 SSB based L1-RSRP test parameters**

| Parameter | | Config | Unit | Test 1 | Test 2 |
|---|---|---|---|---|---|
| SSB GSCN | | 1~3 | | freq1 | freq1 |
| Duplex mode | | 1 | | FDD | FDD |
| | | 2 | | TDD | TDD |
| | | 3 | | TDD | TDD |
| TDD Configuration | | 1 | | N/A | N/A |
| | | 2 | | TDDConf.1.1 | TDDConf.1.1 |
| | | 3 | | TDDConf.2.1 | TDDConf.2.1 |
| $BW_{channel}$ | | 1 | MHz | 10: $N_{RB,c}$ = 52 | 10: $N_{RB,c}$ = 52 |
| | | 2 | | 10: $N_{RB,c}$ = 52 | 10: $N_{RB,c}$ = 52 |
| | | 3 | | 40: $N_{RB,c}$ = 106 | 40: $N_{RB,c}$ = 106 |
| PDSCH Reference measurement channel | | 1 | | SR.1.1 FDD | SR.1.1 FDD |
| | | 2 | | SR.1.1 TDD | SR.1.1 TDD |
| | | 3 | | SR.2.1 TDD | SR.2.1 TDD |
| RMSI CORESET Reference Channel | | 1 | | CR.1.1 FDD | CR.1.1 FDD |
| | | 2 | | CR.1.1 TDD | CR.1.1 TDD |
| | | 3 | | CR.2.1 TDD | CR.2.1 TDD |
| Dedicated CORESET Reference Channel | | 1 | | CCR.1.1 FDD | CCR.1.1 FDD |
| | | 2 | | CCR.1.1 TDD | CCR.1.1 TDD |
| | | 3 | | CCR.2.1 TDD | CCR.2.1 TDD |
| SSB configuration | | 1 | | SSB.3 FR1 | SSB.3 FR1 |
| | | 2 | | SSB.3 FR1 | SSB.3 FR1 |
| | | 3 | | SSB.4 FR1 | SSB.4 FR1 |
| OCNG Patterns | | 1~3 | | OP.1 | OP.1 |
| DL BWP | | 1~3 | | DLBWP.1.1 | DLBWP.1.1 |
| UL BWP | | 1~3 | | ULBWP.1.1 | ULBWP.1.1 |
| SMTC configuration | | 1~3 | | SMTC.1 | SMTC.1 |
| Number of reported RS | | 1~3 | | 2 | 2 |
| L1-RSRP reporting period | | 1~3 | | TBD | TBD |
| EPRE ratio of PSS to SSS | | 1~3 | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | | | | |
| EPRE ratio of OCNG DMRS to SSS Note 1 | | | | | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 | | | | | |
| $N_{oc}$ Note2 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1~3 | dBm/15kHz | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| $N_{oc}$ Note2 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2 | dBm/SSB SCS | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |

| | | | | | |
|---|---|---|---|---|---|
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3 | | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| $\hat{E}_s/I_{ot}$ | | 1~3 | dB | TBD | TBD |
| SSB RSRP Note3 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2 | dBm/SSB SCS | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3 | | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| Io Note3 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2 | dBm/9.36 MHz | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3 | dBm/38.16 MHz | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |

| | | | | |
|---|---|---|---|---|
| $\hat{E}_s / N_{oc}$ | 1~3 | dB | TBD | TBD |
| Propagation condition | 1~3 | | AWGN | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | |

##### A.6.7.4.1.3 Test Requirements

The L1-RSRP measurement accuracy for SSB#0 and SSB#1 of Cell 1 shall fulfil the requirements in sections 10.1.19.1.

Editor's Note: which reports are used to verify the accuracy is FFS

#### A.6.7.4.2 CSI-RS based L1-RSRP measurement

##### A.6.7.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 9.5.3 and section 10.1.19.2 for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in Table A.6.7.4.2.1-1.

**Table A.6.7.4.2.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test**

| Config | Description |
|---|---|
| 1 | NR 15 kHz CSI-RS SCS, 10MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz CSI-RS SCS, 10MHz bandwidth, TDD duplex mode |
| 3 | NR 30kHz CSI-RS SCS, 40MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

##### A.6.7.4.2.2 Test parameters

In this set of test cases there are one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.6.7.4.2.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in Table A.6.7.4.2.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform L1-RSRP measurement based on the CSI-RS resources 0 and 1. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB. Repetition is configured as TBD for the CSI-RS resource set.

**Table A.6.7.4.2.2-1: FR1 CSI-RS based L1-RSRP test parameters**

| Parameter | | Config | Unit | Test 1 | Test 2 |
|---|---|---|---|---|---|
| SSB GSCN | | 1~3 | | freq1 | freq1 |
| Duplex mode | | 1 | | FDD | FDD |
| | | 2 | | TDD | TDD |
| | | 3 | | TDD | TDD |
| TDD Configuration | | 1 | | N/A | N/A |
| | | 2 | | TDDConf.1.1 | TDDConf.1.1 |
| | | 3 | | TDDConf.2.1 | TDDConf.2.1 |
| $BW_{channel}$ | | 1 | MHz | 10: $N_{RB,c}$ = 52 | 10: $N_{RB,c}$ = 52 |
| | | 2 | | 10: $N_{RB,c}$ = 52 | 10: $N_{RB,c}$ = 52 |
| | | 3 | | 40: $N_{RB,c}$ = 106 | 40: $N_{RB,c}$ = 106 |
| PDSCH Reference measurement channel | | 1 | | SR.1.1 FDD | SR.1.1 FDD |
| | | 2 | | SR.1.1 TDD | SR.1.1 TDD |
| | | 3 | | SR.2.1 TDD | SR.2.1 TDD |
| RMSI CORESET Reference Channel | | 1 | | CR.1.1 FDD | CR.1.1 FDD |
| | | 2 | | CR.1.1 TDD | CR.1.1 TDD |
| | | 3 | | CR.2.1 TDD | CR.2.1 TDD |
| Dedicated CORESET Reference Channel | | 1 | | CCR.1.1 FDD | CCR.1.1 FDD |
| | | 2 | | CCR.1.1 TDD | CCR.1.1 TDD |
| | | 3 | | CCR.2.1 TDD | CCR.2.1 TDD |
| SSB configuration | | 1 | | SSB.1 FR1 | SSB.1 FR1 |
| | | 2 | | SSB.1 FR1 | SSB.1 FR1 |
| | | 3 | | SSB.2 FR1 | SSB.2 FR1 |
| OCNG Patterns | | 1~3 | | OP.1 | OP.1 |
| DL BWP | | 1~3 | | DLBWP.1.1 | DLBWP.1.1 |
| UL BWP | | 1~3 | | ULBWP.1.1 | ULBWP.1.1 |
| SMTC configuration | | 1~3 | | SMTC.1 | SMTC.1 |
| CSI-RS 0 | | 1 | | CSI-RS 1.2 FDD | CSI-RS 1.2 FDD |
| | | 2 | | CSI-RS 1.2 TDD | CSI-RS 1.2 TDD |
| | | 3 | | CSI-RS 2.2 TDD | CSI-RS 2.2 FDD |
| CSI-RS 1 | | 1 | | CSI-RS 1.3 FDD | CSI-RS 1.3 FDD |
| | | 2 | | CSI-RS 1.3 TDD | CSI-RS 1.3 TDD |
| | | 3 | | CSI-RS 2.3 TDD | CSI-RS 2.3 FDD |
| Number of reported RS | | 1~3 | | 2 | 2 |
| EPRE ratio of PSS to SSS | | 1~3 | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | | | | |
| EPRE ratio of OCNG DMRS to SSS Note 1 | | | | | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 | | | | | |
| $N_{oc}$ Note2 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1~3 | dBm/15kHz | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| $N_{oc}$ Note2 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2 | dBm/CSI-RS SCS | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |

| | | | | | |
|---|---|---|---|---|---|
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3 | | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| $\hat{E}_s/I_{ot}$ | | 1~3 | dB | TBD | TBD |
| CSI-RS RSRP Note3 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2 | dBm/CSI-RS SCS | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3 | | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| Io Note3 | NR_FDD_FR1_A, NR_TDD_FR1_A | 1,2 | dBm/9.36 MHz | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |
| | NR_FDD_FR1_A, NR_TDD_FR1_A | 3 | dBm/38.16 MHz | TBD | TBD |
| | NR_FDD_FR1_B | | | | TBD |
| | NR_TDD_FR1_C | | | | TBD |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | | | | TBD |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | | | | TBD |
| | NR_FDD_FR1_G | | | | TBD |
| | NR_FDD_FR1_H | | | | TBD |

| | | | | |
|---|---|---|---|---|
| $\hat{E}_s/N_{oc}$ | 1~3 | dB | TBD | TBD |
| Propagation condition | 1~3 | | AWGN | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | |

##### A.6.7.4.2.3 Test Requirements

The L1-RSRP measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 1 shall fulfil the requirements in sections 10.1.19.2.

Editor's Note: which reports are used to verify the accuracy is FFS

# A.7 NR standalone tests in FR2

## A.7.1 SA: RRC_IDLE state mobility

### A.7.1.1 Cell re-selection to NR

#### A.7.1.1.1 Intra-frequency NR case

##### A.7.1.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements specified in clause 4.2.2.3.

##### A.7.1.1.1.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.7.1.1.1.2-1, A.7.1.1.1.2-2 and A.7.1.1.1.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only cell 1 is already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing cell 2.

**Table A.7.1.1.1.2-1: Supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

**Table A.7.1.1.1.2-2: General test parameters for intra frequency NR cell re-selection test case**

| Parameter | | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|---|
| Initial condition | Active cell | | 1, 2 | Cell1 | |
| | Neighbour cells | | 1, 2 | Cell2 | |
| T2 end condition | Active cell | | 1, 2 | Cell2 | |
| | Neighbour cells | | 1, 2 | Cell1 | |
| Final condition | Visited cell | | 1, 2 | Cell1 | |
| RF Channel Number | | | 1, 2 | 1 | |
| Time offset between cells | | | 1, 2 | 3 μs | Synchronous cells |
| Access Barring Information | | - | 1, 2 | Not Sent | No additional delays in random access procedure. |
| SSB configuration | | | 1 | SSB.1 FR2 | |
| | | | 2 | SSB.2 FR2 | |
| SMTC configuration | | | 1, 2 | SMTC pattern 1 | |
| DRX cycle length | | s | 1, 2 | 1.28 | The value shall be used for all cells in the test. |
| PRACH configuration index | | | 1, 2 | 87 | The detailed configuration is specified in TS 38.211 clause 6.3.3.2 |
| rangeToBestCell | | | 1, 2 | Not configured | |
| T1 | | s | 1, 2 | [TBD] | During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2 |
| T2 | | s | 1, 2 | [TBD] | T2 needs to be defined so that cell re-selection reaction time is taken into account. |
| T3 | | s | 1, 2 | [TBD] | T3 needs to be defined so that cell re-selection reaction time is taken into account. |

**Table A.7.1.1.1.2-3: Cell specific test parameters for intra frequency NR cell re-selection test case in AWGN**

| Parameter | Unit | Test configuration | Cell 1 | | | Cell 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| TDD configuration | | 1, 2 | TDDConf.3.1 | | | TDDConf.3.1 | | |
| PDSCH RMC configuration | | 1 | SR.3.1 TDD | | | N/A | | |
| | | 2 | SR.3.1 TDD | | | | | |
| RMSI CORESET RMC configuration | | 1 | CR.3.1 TDD | | | CR.3.1 TDD | | |
| | | 2 | CR.3.1 TDD | | | CR.3.1 TDD | | |
| Dedicated CORESET RMC configuration | | 1 | CCR.3.1 TDD | | | CCR.3.1 TDD | | |
| | | 2 | CCR.3.1 TDD | | | CCR.3.1 TDD | | |
| OCNG Pattern | | 1, 2 | OP.1 defined in A.3.2.1 | | | OP.1 defined in A.3.2.1 | | |
| Initial DL BWP configuration | | 1, 2 | DLBWP.0 | | | DLBWP.0 | | |
| Initial UL BWP configuration | | 1, 2 | ULBWP.0 | | | ULBWP.0 | | |
| RLM-RS | | 1, 2 | SSB | | | SSB | | |
| Qrxlevmin | dBm/SCS | 1 | TBD | | | TBD | | |
| | | 2 | TBD | | | TBD | | |
| Pcompensation | dB | 1, 2 | 0 | | | 0 | | |
| $Qhyst_s$ | dB | 1, 2 | 0 | | | 0 | | |
| $Qoffset_{s, n}$ | dB | 1, 2 | 0 | | | 0 | | |
| Cell_selection_and_ reselection_quality_ measurement | | 1, 2 | SS-RSRP | | | SS-RSRP | | |
| AoA setup | | 1, 2 | TBD | | | TBD | | |
| $\hat{E}_s/I_{ot}$ | dB | 1 | TBD | TBD | TBD | -infinity | TBD | TBD |
| | | 2 | | | | | | |
| $N_{oc}$ Note2 | dBm/SCS | 1 | TBD | | | | | |
| | | 2 | TBD | | | | | |
| $N_{oc}$ Note2 | dBm/15 kHz | 1 | TBD | | | | | |
| | | 2 | | | | | | |
| $\hat{E}_s/N_{oc}$ | dB | 1 | TBD | TBD | TBD | -infinity | TBD | TBD |
| | | 2 | | | | | | |
| SS-RSRP Note3 | dBm/SCS | 1 | TBD | TBD | TBD | -infinity | TBD | TBD |
| | | 2 | TBD | TBD | TBD | -infinity | TBD | TBD |
| Io | dBm/95.04 MHz | 1 | TBD | TBD | TBD | -infinity | TBD | TBD |
| | | 2 | TBD | TBD | TBD | -infinity | TBD | TBD |
| Treselection | s | 1, 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sintrasearch | dB | 1, 2 | Not sent | | | Not sent | | |
| Propagation Condition | | 1, 2 | AWGN | | | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | | | |

### A.7.1.1.1.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the RRC CONNECTION REQUEST message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than [TBD] s.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on cell 1, and starts to send preambles on the PRACH for sending the RRC CONNECTION REQUEST message to perform a Tracking Area Update procedure on cell 1.

The cell re-selection delay shall be less than [TBD] s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR\_Intra}$ + $T_{SI\text{-}NR}$, and to an already detected cell can be expressed as: $T_{evaluate, NR\_ intra}$ + $T_{SI\text{-}NR}$,

Where:

$T_{detect, NR\_Intra}$ See Table 4.2.2.3-1 in clause 4.2.2.3

$T_{evaluate, NR\_ intra}$ See Table 4.2.2.3-1 in clause 4.2.2.3

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 2560 ms is assumed in this test case.

This gives a total of [TBD] s, allow [TBD] s for the cell re-selection delay to a newly detectable cell and [TBD] s for the cell re-selection delay to an already detected cell in the test case, which we allow [TBD] s.

### A.7.1.1.2 Cell reselection to FR2 inter-frequency NR case

#### A.7.1.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements specified in clause 4.2.2.4.

#### A.7.1.1.2.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.7.1.1.2.2-1, A.7.1.1.2.2-2 and A.7.1.1.2.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas and cell 2 is of higher priority than cell 1. Furthermore, UE has not registered with network for the tracking area containing cell 2.

**Table A.7.1.1.2.2-1: Supported test configurations**

| Configuration | Description for serving cell | Description for target cell |
|---|---|---|
| 1 | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode | 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | | |

**Table A.7.1.1.2.2-2: General test parameters for FR2 inter frequency NR cell re-selection test case**

| Parameter | | Unit | Test configuration | Value | Comment |
|---|---|---|---|---|---|
| Initial condition | Active cell | | 1, 2 | Cell2 | The UE camps on cell 2 in the initial phase and during T1 period the UE reselects to cell 1 |
| T1 end condition | Active cell | | 1, 2 | Cell1 | The UE shall perform reselection to cell 1 during T1 |
| | Neighbour cells | | 1, 2 | Cell2 | |
| T3 end condition | Active cell | | 1, 2 | Cell2 | The UE shall perform reselection to cell 2 with higher priority during T3 |
| RF Channel Number | | | 1, 2 | 1, 2 | |
| Time offset between cells | | | 1, 2 | 3 µs | Synchronous cells |
| Access Barring Information | | - | 1, 2 | Not Sent | No additional delays in random access procedure. |
| SSB configuration | | | 1 | SSB.1 FR2 | |
| | | | 2 | SSB.2 FR2 | |
| SMTC configuration | | | 1, 2 | SMTC pattern 1 | |
| DRX cycle length | | s | 1, 2 | 1.28 | The value shall be used for all cells in the test. |
| PRACH configuration index | | | 1, 2 | 87 | The detailed configuration is specified in TS 38.211 clause 6.3.3.2 |
| rangeToBestCell | | | 1, 2 | Not configured | |
| T1 | | s | 1, 2 | [TBD] | T1 needs to be defined so that cell re-selection reaction time is taken into account. |
| T2 | | s | 1, 2 | [TBD] | During T2, cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that cell 2 has not been detected by the UE prior to the start of period T3. |
| T3 | | s | 1, 2 | [TBD] | T3 needs to be defined so that cell re-selection reaction time is taken into account. |

**Table A.7.1.1.2.2-3: Cell specific test parameters for FR2 inter frequency NR cell re-selection test case in AWGN**

| Parameter | Unit | Test configuration | Cell 1 | | | Cell 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| TDD configuration | | 1, 2 | TDDConf.3.1 | | | TDDConf.3.1 | | |
| PDSCH RMC configuration | | 1, 2 | SR.3.1 TDD | | | N/A | | |
| RMSI CORESET parameters | | 1, 2 | CR.3.1 TDD | | | CR.3.1 TDD | | |
| RMSI CORESET RMC configuration | | 1, 2 | CCR.3.1 TDD | | | CCR.3.1 TDD | | |
| OCNG Pattern | | 1, 2 | OP.1 defined in A.3.2.1 | | | OP.1 defined in A.3.2.1 | | |
| Initial DL BWP configuration | | 1, 2 | DLBWP.0 | | | DLBWP.0 | | |
| Initial UL BWP configuration | | 1, 2 | ULBWP.0 | | | ULBWP.0 | | |
| RLM-RS | | 1, 2 | SSB | | | SSB | | |
| Qrxlevmin | dBm/SCS | 1 | TBD | | | TBD | | |
| | | 2 | TBD | | | TBD | | |
| Pcompensation | dB | 1, 2 | 0 | | | 0 | | |
| $Qhyst_s$ | dB | 1, 2 | 0 | | | 0 | | |
| $Qoffset_{s,n}$ | dB | 1, 2 | 0 | | | 0 | | |
| Cell_selection_and_reselection_quality_measurement | | 1, 2 | SS-RSRP | | | SS-RSRP | | |
| AoA setup | | 1, 2 | TBD | | | TBD | | |
| $\hat{E}_s/I_{ot}$ | dB | 1 | TBD | TBD | TBD | TBD | -infinity | TBD |
| | | 2 | | | | | | |
| $N_{oc}$ Note2 | dBm/SCS | 1 | TBD | | | | | |
| | | 2 | TBD | | | | | |
| $N_{oc}$ Note2 | dBm/15 kHz | 1 | TBD | | | | | |
| | | 2 | | | | | | |
| $\hat{E}_s/N_{oc}$ | dB | 1 | TBD | TBD | TBD | TBD | -infinity | TBD |
| | | 2 | | | | | | |
| SS-RSRP Note3 | dBm/SCS | 1 | TBD | TBD | TBD | TBD | -infinity | TBD |
| | | 2 | TBD | TBD | TBD | TBD | -infinity | TBD |
| Io | dBm/95.04 MHz | 1 | TBD | TBD | TBD | TBD | -infinity | TBD |
| | | 2 | TBD | TBD | TBD | TBD | -infinity | TBD |
| Treselection | s | 1, 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sintrasearch | dB | 1, 2 | TBD | | | Not sent | | |
| $Thresh_{x, high}$ | dB | 1, 2 | TBD | | | TBD | | |
| $Thresh_{serving, low}$ | dB | 1, 2 | TBD | | | TBD | | |
| $Thresh_{x, low}$ | dB | 1, 2 | TBD | | | TBD | | |
| Propagation Condition | | 1, 2 | AWGN | | | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | | | |

### A.7.1.1.2.3 Test Requirements

The cell reselection delay to a higher priority cell is defined as the time from the beginning of time period T3, to the moment when the UE camps again on cell 2, and starts to send preambles on the PRACH for sending the RRC CONNECTION REQUEST message to perform a Tracking Area Update procedure on cell 2.

The cell re-selection delay to a higher priority cell shall be less than [TBD] s.

The cell reselection delay to a lower priority cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on cell 1, and starts to send preambles on the PRACH for sending the RRC CONNECTION REQUEST message to perform a Tracking Area Update procedure on cell 1.

The cell re-selection delay to a lower priority cell shall be less than [TBD] s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher\_priority\_search} + T_{evaluate, NR\_ inter} + T_{SI-NR}$, and to a lower priority cell can be expressed as: $T_{evaluate, NR\_ inter} + T_{SI-NR}$,

Where:

$T_{higher\_priority\_search}$ See clause 4.2.2.7

$T_{evaluate, NR\_ inter}$ See Table 4.2.2.4-1 in clause 4.2.2.4

$T_{SI-NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 2560 ms is assumed in this test case.

This gives a total of [TBD] s, allow [TBD] s for the cell re-selection delay to a higher priority cell and [TBD] s for the cell re-selection delay to a lower priority cell in the test case, which we allow [TBD] s.

# A.7.2 SA: RRC_INACTIVE state mobility

# A.7.3 RRC_CONNECTED state mobility

## A.7.3.1 Handover

### A.7.3.1.1 Inter-frequency handover from FR1 to FR2; unknown target cell

#### A.7.3.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR2 inter frequency handover requirements specified in clause 6.1.1.5 [TS38.133 v15.2.1].

#### A.7.3.1.1.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.2.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.7.3.1.1.2-2, and A.7.3.1.1.2-3.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. Starting T2, cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

**Table A.7.3.1.1.2-1: Inter-frequency handover from FR1 to FR2 test configurations**

| Config | Description |
|---|---|
| 1 | Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode<br>Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode<br>Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 3 | Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode<br>Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

**Table A.7.3.1.1.2-2: General test parameters Inter-frequency handover from FR1 to FR2**

| Parameter | | Unit | Value | Comment |
|---|---|---|---|---|
| Initial conditions | Active cell | | Cell 1 | |
| | Neighbouring cell | | Cell 2 | |
| Final condition | Active cell | | Cell 2 | |
| A4-Offset | | dB | [TBD] | |
| Hysteresis | | dB | 0 | |
| Time To Trigger | | s | 0 | |
| Filter coefficient | | | 0 | L3 filtering is not used |
| Access Barring Information | | - | Not Sent | No additional delays in random access procedure. |
| Time offset between cells | | | 3 μs | Synchronous cells |
| T1 | | s | 5 | |
| T2 | | s | ≤10 | |
| T3 | | s | 1 | |

**Table A.7.3.1.1.2-3: Cell specific test parameters for NR FR1-FR2 Inter frequency handover test case**

| Parameter | Unit | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|
| | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | 1 | | 2 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Duplex mode | Config 1 | | FDD | | TDD | |
| | Config 2,3 | | TDD | | TDD | |
| TDD configuration | Config 1 | | Not Applicable | | TDDConf.3.1 | |
| | Config 2 | | TDDConf.1.1 | | TDDConf.3.1 | |
| | Config 3 | | TDDConf.2.1 | | TDDConf.3.1 | |
| $BW_{channel}$ | Config 1 | MHz | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | Config 2 | | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | Config 3 | | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | Config 1 | MHz | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | Config 2 | | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | Config 3 | | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| DRx Cycle | | ms | Not Applicable | | | |
| PDSCH Reference measurement channel | Config 1 | | SR.1.1 FDD | | SR3.1 TDD | |
| | Config 2 | | SR.1.1 TDD | | SR3.1 TDD | |
| | Config 3 | | SR2.1 TDD | | SR3.1 TDD | |
| CORESET Reference Channel | Config 1 | | CR.1.1 FDD | | CR3.1 TDD | |
| | Config 2 | | CR.1.1 TDD | | CR3.1 TDD | |
| | Config 3 | | CR2.1 TDD | | CR3.1 TDD | |
| OCNG Patterns | | | OCNG pattern 1 | | | |
| SMTC configuration | Config 1,2 | | SMTC.1 FR1 | | SMTC.1 FR2 | |
| | Config 3 | | SMTC.2 FR1 | | SMTC.1 FR2 | |
| PDSCH/PDCCH subcarrier spacing | Config 1,2 | kHz | 15 kHz | | 120 kHz | |
| | Config 3 | | 30 kHz | | 120 kHz | |
| PUCCH/PUSCH subcarrier spacing | Config 1,2 | kHz | 15 kHz | | 120 kHz | |
| | Config 3 | | 30 kHz | | 120 kHz | |
| PRACH configuration | | | FR1 PRACH configuration 1 | | FR2 PRACH configuration 1 | |
| TRS configuration | | | TBD | | TBD | |
| BWP configuraiton | Initial DL BWP | | DLBWP.0.1 | | DLBWP.0.1 | |
| | Dedicated DL BWP | | DLBWP.1.1 | | DLBWP.1.1 | |
| | Initial UL BWP | | ULBWP.0.1 | | ULBWP.0.1 | |
| | Dedicated UL BWP | | ULBWP.1.1 | | ULBWP.1.1 | |
| EPRE ratio of PSS to SSS | | dB | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| $N_{oc}$ Note2 | | dBm/15kHz | TBD | | TBD | |
| $N_{oc}$ Note2 | Config 1,2 | dBm/SCS | TBD | | TBD | |
| | Config 3 | | TBD | | TBD | |
| $\hat{E}_s/I_{ot}$ | | dB | TBD | TBD | -Infinity | TBD |

| | | | | | | |
|---|---|---|---|---|---|---|
| $\hat{E}_s/N_{oc}$ | | dB | TBD | TBD | -Infinity | TBD |
| Io Note3 | Config 1,2 | dBm/ BW | TBD | TBD | TBD | TBD |
| | Config 3 | dBm/ BW | TBD | TBD | TBD | TBD |
| Propagation condition | | - | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone | | | | | | |

##### A.7.3.1.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than [TBD] ms from the beginning of time period T2. The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = [TBD] ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = [TBD] ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2 [TS38.133].

This gives a total of [TBD] ms.

#### A.7.3.1.2 Intra-frequency handover from FR2 to FR2; unknown target cell

##### A.7.3.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 intra frequency handover requirements specified in clause 6.1.1.4 [TS38.133 v15.2.1].

##### A.7.3.1.2.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.2.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.7.3.1.2.2-2, and A.7.3.1.2.2-3.

The test scenario comprises of carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. Starting T2, cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

**Table A.7.3.1.2.2-1: Intra-frequency handover from FR2 to FR2 test configurations**

| Config | Description |
|---|---|
| 1 | Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode<br>Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |

**Table A.7.3.1.2.2-2: General test parameters Intra-frequency handover from FR2 to FR2**

| Parameter | | Unit | Value | Comment |
|---|---|---|---|---|
| Initial conditions | Active cell | | Cell 1 | |
| | Neighbouring cell | | Cell 2 | |
| Final condition | Active cell | | Cell 2 | |
| A4-Offset | | dB | [TBD] | |
| Hysteresis | | dB | 0 | |
| Time To Trigger | | s | 0 | |
| Filter coefficient | | | 0 | L3 filtering is not used |
| Access Barring Information | | - | Not Sent | No additional delays in random access procedure. |
| Time offset between cells | | | 3 μs | Synchronous cells |
| T1 | | s | 5 | |
| T2 | | s | ≤10 | |
| T3 | | s | 1 | |

**Table A.7.3.1.2.2-3: Cell specific test parameters for NR FR2-FR2 Intra frequency handover test case**

| Parameter | Unit | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|
| | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | 1 | | 1 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Duplex mode | | | TDD | | | |
| TDD configuration | | | TDDConf.3.1 | | | |
| $BW_{channel}$ | | MHz | 100: $N_{RB,c}$ = 66 | | | |
| BWP BW | | MHz | 100: $N_{RB,c}$ = 66 | | | |
| DRx Cycle | | ms | Not Applicable | | | |
| PDSCH Reference measurement channel | | | SR3.1 TDD | | | |
| CORESET Reference Channel | | | CR3.1 TDD | | | |
| OCNG Patterns | | | OCNG pattern 1 | | | |
| SMTC configuration | | | SMTC.1 FR2 | | | |
| PDSCH/PDCCH subcarrier spacing | | kHz | 120 kHz | | | |
| PUCCH/PUSCH subcarrier spacing | | kHz | 120 kHz | | | |
| PRACH configuration | | | FR2 PRACH configuration 1 | | | |
| TRS configuration | | | TBD | | | |
| TCI configuration | | | TBD | | | |
| BWP configuraiton | Initial DL BWP | | DLBWP.0.1 | | | |
| | Dedicated DL BWP | | DLBWP.1.1 | | | |
| | Initial UL BWP | | ULBWP.0.1 | | | |
| | Dedicated UL BWP | | ULBWP.1.1 | | | |
| EPRE ratio of PSS to SSS | | dB | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| $N_{oc}$ Note2 | | dBm/15kHz | TBD | | TBD | |
| $N_{oc}$ Note2 | Config 1,2 | dBm/SCS | TBD | | TBD | |
| | Config 3 | | TBD | | TBD | |
| $\hat{E}_s/I_{ot}$ | | dB | TBD | TBD | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | | dB | TBD | TBD | TBD | TBD |
| Io Note3 | Config 1,2 | dBm/BW | TBD | TBD | TBD | TBD |
| | Config 3 | dBm/BW | TBD | TBD | TBD | TBD |
| Propagation condition | | - | AWGN | | | |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone

### A.7.3.1.2.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than [TBD] ms from the beginning of time period T2. The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = [TBD] ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = [TBD] ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2 [TS38.133].

This gives a total of [TBD] ms.

#### A.7.3.1.3 Inter-frequency handover from FR2 to FR2; unknown target cell

##### A.7.3.1.3.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 inter frequency handover requirements specified in clause 6.1.1.4 [TS38.133 v15.2.1].

##### A.7.3.1.3.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.3.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.7.3.1.3.2-2, and A.7.3.1.3.2-3.

The test scenario comprises of carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. Starting T2, cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

**Table A.7.3.1.3.2-1: Inter-frequency handover from FR2 to FR2 test configurations**

| Config | Description |
|---|---|
| 1 | Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode<br>Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |

**Table A.7.3.1.3.2-2: General test parameters Inter-frequency handover from FR2 to FR2**

| Parameter | | Unit | Value | Comment |
|---|---|---|---|---|
| Initial conditions | Active cell | | Cell 1 | |
| | Neighbouring cell | | Cell 2 | |
| Final condition | Active cell | | Cell 2 | |
| A4-Offset | | dB | [TBD] | |
| Hysteresis | | dB | 0 | |
| Time To Trigger | | s | 0 | |
| Filter coefficient | | | 0 | L3 filtering is not used |
| Access Barring Information | | - | Not Sent | No additional delays in random access procedure. |
| Time offset between cells | | | 3 μs | Synchronous cells |
| T1 | | s | 5 | |
| T2 | | s | ≤10 | |
| T3 | | s | 1 | |

**Table A.7.3.1.3.2-3: Cell specific test parameters for NR FR2-FR2 Inter frequency handover test case**

| Parameter | Unit | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|
| | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | 1 | | 2 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Duplex mode | | | TDD | | | |
| TDD configuration | | | TDDConf.3.1 | | | |
| $BW_{channel}$ | | MHz | 100: $N_{RB,c}$ = 66 | | | |
| BWP BW | | MHz | 100: $N_{RB,c}$ = 66 | | | |
| DRx Cycle | | ms | Not Applicable | | | |
| PDSCH Reference measurement channel | | | SR3.1 TDD | | | |
| CORESET Reference Channel | | | CR3.1 TDD | | | |
| OCNG Patterns | | | OCNG pattern 1 | | | |
| SMTC configuration | | | SMTC.1 FR2 | | | |
| PDSCH/PDCCH subcarrier spacing | | kHz | 120 kHz | | | |
| PUCCH/PUSCH subcarrier spacing | | kHz | 120 kHz | | | |
| PRACH configuration | | | FR2 PRACH configuration 1 | | | |
| TRS configuration | | | TBD | | | |
| TCI configuration | | | TBD | | | |
| BWP configuraiton | Initial DL BWP | | DLBWP.0.1 | | | |
| | Dedicated DL BWP | | DLBWP.1.1 | | | |
| | Initial UL BWP | | ULBWP.0.1 | | | |
| | Dedicated UL BWP | | ULBWP.1.1 | | | |
| EPRE ratio of PSS to SSS | | dB | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | |
| $N_{oc}$ Note2 | | dBm/15kHz | TBD | | TBD | |
| $N_{oc}$ Note2 | Config 1,2 | dBm/SCS | TBD | | TBD | |
| | Config 3 | | TBD | | TBD | |
| $\hat{E}_s/I_{ot}$ | | dB | TBD | TBD | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | | dB | TBD | TBD | TBD | TBD |
| Io Note3 | Config 1,2 | dBm/ BW | TBD | TBD | TBD | TBD |
| | Config 3 | dBm/ BW | TBD | TBD | TBD | TBD |
| Propagation condition | | - | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone | | | | | | |

## A.7.3.1.3.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than [TBD] ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = [TBD] ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = [TBD] ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2 [TS38.133].

This gives a total of [TBD] ms.

## A.7.3.2 RRC Connection Mobility Control

### A.7.3.2.1 SA: RRC Re-establishment

### A.7.3.2.2 Random Access

#### A.7.3.2.2.1 Contention based random access test in FR2 for NR Standalone

##### A.7.3.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.2 and Clause 7.1.2 in an AWGN model.

For this test one cell is used, with the configuration of Cell 1 configured as PCell or SCell in FR2. Supported test parameters are shown in Table A.7.3.2.2.1.1-1. UE capble of SA with PCell or SCell in FR2 needs to be tested by using the parameters in Table A.7.3.2.2.1.1-2 and Table A.7.3.2.2.1.1-3.

**Table A.7.3.2.2.1.1-1: Supported test configurations for contention based random access test in FR2 for NR Standalone**

| Config | Description |
|---|---|
| 1 | NR PSCell/SCell 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability | |

**Table A.7.3.2.2.1.1-2: General test parameters for contention based random access test in FR2 for NR Standalone**

| Parameter | | Unit | Test-1 | Comments |
|---|---|---|---|---|
| SSB Configuration | Config 1,2 | | SSB pattern 1 in FR2 | As defined in A.3.10, except for for number of SSBs per SS-burst and SS/PBCH block index as below |
| Number of SSBs per SS-burst | | | 2 | Different from the definition in A.3.10 |
| SS/PBCH block index | | | 0,1 | Different from the definition in A.3.10 |
| Duplex Mode for Cell 2 | Config 1,2 | | TDD | |
| TDD Configuration | Config 1,2 | | TDDConf.3.1 | |
| OCNG Pattern Note 1 | | | OCNG pattern 1 | As defined in A.3.2.1. |
| PDSCH parameters Note 2 | Config 1,2 | | SR3.1 TDD | As defined in A.3.1.1. |
| NR RF Channel Number | | | 1 | |
| EPRE ratio of PSS to SSS | | dB | 0 | |
| EPRE ratio of PBCH_DMRS to SSS | | dB | | |
| EPRE ratio of PBCH to PBCH_DMRS | | dB | | |
| EPRE ratio of PDCCH_DMRS to SSS | | dB | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | dB | | |
| EPRE ratio of PDSCH_DMRS to SSS | | dB | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | dB | | |
| Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.<br>Note 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required. | | | | |

**Table A.7.3.2.2.1.1-3: OTA-related test parameters for contention based random access test in FR2 for NR Standalone**

| Parameter | | | Unit | Test-1 | Comments |
|---|---|---|---|---|---|
| AoA setup | | | | TBD | As defined in A.x. |
| SSB with index 0 | $\hat{E}_s/I_{ot}$ | | dB | 3 | SSB with index 0 is signalled to be above configured *rsrp-ThresholdSSB* |
| | $N_{oc}$ | Config 1,2 | dBm/15kHz | TBD | |
| | $\hat{E}_s/N_{oc}$ | | dB | 3 | |
| | SS-RSRP Note 2 | | dBm/ SCS | TBD | |
| SSB with index 1 | $\hat{E}_s/I_{ot}$ | | dB | -17 | SSB with index 1 is signalled to be below configured *rsrp-ThresholdSSB* |
| | $N_{oc}$ | Config 1,2 | dBm/15kHz | TBD | |
| | $\hat{E}_s/N_{oc}$ | | dB | -17 | |
| | SS-RSRP Note 2 | | dBm/ SCS | TBD | |
| Io Note 1 | | Config 1,2 | dBm | TBD | For symbols without SSB index 1 |
| ss-PBCH-BlockPower | | | dBm/ SCS | TBD | As defined in clause 6.3.2 in TS 38.331 [2]. |
| Configured UE transmitted power ( $P_{\text{CMAX, f,c}}$ ) | | | dBm | TBD | As defined in clause 6.2.4 in TS 38.101-2. |
| PRACH Configuration | | | | FR2 PRACH configuration 1 | As defined in A.3.8.3. |
| Propagation Condition | | | - | AWGN | |
| Note 1: Io level has been derived from other parameters for information purpose. It is not a settable parameter.<br>Note 2: RSRP level has been derived from other parameters for information purposes. It is not a settable parameter. | | | | | |

### A.7.3.2.2.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

#### A.7.3.2.2.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in Subclause 6.2.2.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be [TBD] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

#### A.7.3.2.2.1.2.2 Random Access Response Reception

To test the UE behavior specified in Subclause 6.2.2.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be [TBD] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.7.3.2.2.1.2.3 No Random Access Response Reception

To test the UE behavior specified in subclause 6.2.2.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be [TBD] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.7.3.2.2.1.2.4 Receiving a NACK on msg3

To test the UE behavior specified in subclause 6.2.2.2.1.4 the System Simulator shall NACK *all* UE msg3 following a successful Random Access Response.

The UE shall re-transmit the msg3 upon the reception of a NACK on msg3 until the maximum number of HARQ re-transmissions is reached.

###### A.7.3.2.2.1.2.5 Reception of an Incorrect Message over Temporary C-RNTI

To test the UE behavior specified in Subclause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element *not* matching the CCCH SDU transmitted in msg3 uplink message.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

###### A.7.3.2.2.1.2.6 Reception of a Correct Message over Temporary C-RNTI

To test the UE behavior specified in Subclause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element matching the CCCH SDU transmitted in the msg3 uplink message.

The UE shall send ACK if the Contention Resolution is successful.

###### A.7.3.2.2.1.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in Subclause 6.2.2.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

##### A.7.3.2.2.2 Non-contention based random access test in FR2 for NR Standalone

###### A.7.3.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.2 and Clause 7.1.2 in an AWGN model.

For this test one cell is used, with the configuration of Cell 1 configured as PCell or SCell in FR2. Supported test parameters are shown in Table A.7.3.2.2.2.1-1. UE capble of SA with PCell or SCell in FR2 needs to be tested by using the parameters in Table A.7.3.2.2.2.1-2 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2).

**Table A.7.3.2.2.2.1-1: Supported test configurations for non-contention based random access test in FR2 for NR Standalone**

| Config | Description |
|---|---|
| 1 | NR PSCell/SCell 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability | |

**Table A.7.3.2.2.2.1-2: General test parameters for non-contention based random access test in FR2 for NR Standalone**

| Parameter | | Unit | Test-1 | Test-2 | Comments |
|---|---|---|---|---|---|
| SSB Configuration | Config 1,2 | | SSB pattern 1 in FR2 | SSB pattern 1 in FR2 | As defined in A.3.10, except of Number of SS per SS-burst and SS/PBCH block index below |
| Number of SSBs per SS-burst | | | 2 | 2 | Different from the defini in A.3.10 |
| SS/PBCH block index | | | 0,1 | 0,1 | Different from the defini in A.3.10 |
| CSI-RS Configuration | Config 1,2 | | N/A | CSI-RS.3.1 TDD | As defined in A.3.1.4 |
| Duplex Mode for Cell 2 | Config 1,2 | | TDD | TDD | |
| TDD Configuration | Config 1,2 | | TDDConf.3.1 | TDDConf.3.1 | |
| OCNG Pattern Note 1 | | | OCNG pattern 1 | OCNG pattern 1 | As defined in A.3.2.1 |
| PDSCH parameters Note 2 | Config 1,2 | | SR3.1 TDD | SR3.1 TDD | As defined in A.3.1.1 |
| NR RF Channel Number | | | 1 | 1 | |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 | |
| EPRE ratio of PBCH_DMRS to SSS | | dB | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | dB | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | dB | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | dB | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | dB | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | dB | | | |
| Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achiev for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel. | | | | | |
| Note 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required. | | | | | |

**Table A.7.3.2.2.2.1-3: OTA-related test parameters for non-contention based random access test in FR2 for NR Standalone**

| Parameter | | | Unit | Test-1 | Test-2 | Comments |
|---|---|---|---|---|---|---|
| AoA setup | | | | TBD | TBD | As defined in A.x. |
| SSB with index 0 | $\hat{E}_s/I_{ot}$ | | dB | 3 | 3 | SSB with index 0 is signalled to be above configured *rsrp-ThresholdSSB* |
| | $N_{oc}$ | Config 1,2 | dBm/15kHz | TBD | TBD | |
| | $\hat{E}_s/N_{oc}$ | | dB | 3 | 3 | |
| | SS-RSRP Note 2 | | dBm/ SCS | TBD | TBD | |
| SSB with index 1 | $\hat{E}_s/I_{ot}$ | | dB | -17 | -17 | SSB with index 1 is signalled to be below configured *rsrp-ThresholdSSB* |
| | $N_{oc}$ | Config 1,2 | dBm/15kHz | TBD | TBD | |
| | $\hat{E}_s/N_{oc}$ | | dB | -17 | -17 | |
| | SS-RSRP Note 2 | | dBm/ SCS | TBD | TBD | |
| Io Note 1 | | Config 1,2 | dBm | TBD | TBD | For symbols without S index 1 |
| ss-PBCH-BlockPower | | | dBm/ SCS | TBD | TBD | As defined in clause 6. in TS 38.331 [2]. |
| Configured UE transmitted power ( $P_{\text{CMAX, f,c}}$ ) | | | dBm | TBD | TBD | As defined in clause 6. in TS 38.101-2. |
| PRACH Configuration | | | | FR2 PRACH configuration 2 | FR2 PRACH configuration 3 | As defined in A.3.8. |
| Propagation Condition | | | - | AWGN | AWGN | |
| Note 1: Io level has been derived from other parameters for information purpose. It is not a settable parameter.<br>Note 2: RSRP level has been derived from other parameters for information purposes. It is not a settable parameter. | | | | | | |

### A.7.3.2.2.2.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

#### A.7.3.2.2.2.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in Subclause 6.2.2.2.2.1 for SSB-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be [TBD] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

#### A.7.3.2.2.2.2.2 CSI-RS-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in Subclause 6.2.2.2.2.1 for CSI-RS-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the CSI-RS configured.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-OccasionList*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be [TBD] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.7.3.2.2.2.2.3 Random Access Response Reception

To test the UE behavior specified in Subclause 6.2.2.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be [TBD] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

###### A.7.3.2.2.2.2.4 No Random Access Response Reception

To test the UE behavior specified in subclause 6.2.2.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Subclause 6.2.2.2. The power of the first preamble shall be [TBD] dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Subclause 7.1.2.

#### A.7.3.2.3 SA: RRC Connection Release with Redirection

## A.7.4 Timing

### A.7.4.1 UE transmit timing

#### A.7.4.1.1 NR UE Transmit Timing Test for FR2

##### A.7.4.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in Table 7.4.1.1.1-1.

**Table A.7.4.1.1.1-1: Supported test configurations for FR2 PCell**

| Configuration | Description |
|---|---|
| 1 | LTE FDD, NR TDD, SSB SCS 240 kHz, data SCS 120kHz, BW 100MHz |
| 2 | LTE TDD, NR TDD, SSB SCS 240 kHz, data SCS 120kHz, BW 100MHz |

For this test a single NR cell is used. Table A.7.4.1.1.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in Table A.7.4.1.1.1-3.

**Table A.7.4.1.1.1-2: Cell Specific Test Parameters for UL Transmit Timing test**

| Parameter | | Unit | Config | Test1 | Test2 |
|---|---|---|---|---|---|
| E-UTRA Channel Number | | | 1,2 | 1 | 1 |
| NR Channel Number | | | 1,2 | 2 | 2 |
| TDD configuration | | | 1 | TDDConf.1.2 | |
| $BW_{channel}$ | | MHz | 1,2 | 100: NRB,c = 66 | |
| BWP | DL BWP | | 1,2 | DLBWP.1.1 | |
| | UL BWP | | 1,2 | ULBWP.1.1 | |
| DRx Cycle | | ms | 1,2 | N/A | 320[Note5] |
| PDSCH Reference measurement channel | | | 1,2 | SR.3.1 TDD | |
| RMSI CORESET Reference Channel | | | 1,2 | CR.3.1 TDD | |
| Dedicated CORESET Reference Channel | | | 1,2 | CCR.3.1 TDD | |
| OCNG Patterns | | | 1,2 | OP.1 | |
| SSB Configuration | | | 1,2 | SSB.2 FR2 | |
| SMTC configuration | | | 1,2 | SMTC.2 | |
| TCI configuration | | | 1,2 | TBD | |
| TRS configuration | | | 1,2 | TBD | |
| EPRE ratio of PSS to SSS | | dB | 1,2 | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | |
| $N_{oc}$ Note2 | | dBm/15 kHz | 1,2 | TBD | TBD |
| $N_{oc}$ Note2 | | dBm/SCS | 1,2 | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | | | 1,2 | 3 | 3 |
| $\hat{E}_s/N_{oc}$ | | | 1,2 | 3 | 3 |
| SS-RSRP[Note3] | | dBm/SCS | 1,2 | TBD | TBD |

| | | | | |
|---|---|---|---|---|
| Io[Note3] | dBm/95MHz | 1,2 | TBD | TBD |
| Propagation condition | | 1,2 | AWGN | |
| SRS Config | | 1,2 | Config1[Note6] | Config2[Note6] |

**Table A.7.4.1.1.1-3 SRS Configuration for Timing Accuracy Test**

| | Field | Config1 | Config 2 | Comments |
|---|---|---|---|---|
| SRS-ResourceSet | srs-ResourceSetId | 0 | 0 | |
| | srs-ResourceIdList | 0 | 0 | |
| | resourceType | Periodic | Periodic | |
| | Usage | Codebook | Codebook | |
| | SRS-ResourceSetId | 0 | 0 | |
| SRS-Resource | nrofSRS-Ports | Port1 | Port1 | |
| | transmissionComb | n2 | n2 | |
| | combOffset-n2 | 0 | 0 | |
| | cyclicShift-n2 | 0 | 0 | |
| | resourceMapping startPosition | 0 | 0 | |
| | resourceMapping nrofSymbols | n1 | n1 | |
| | resourceMapping repetitionFactor | n1 | n1 | |
| | freqDomainPosition | 0 | 0 | |
| | freqDomainShift | 0 | 0 | |
| | freqHopping c-SRS | sl1 | sl1 | |
| | freqHopping b-SRS | 0 | 0 | |
| | freqHopping b-hop | 0 | 0 | |
| | groupOrSequenceHopping | Neither | Neither | |
| | resourceType | Periodic | Periodic | |
| | periodicityAndOffset-p | sl1 | sl640 | Offset to align with DRx periodicity |
| | sequenceId | 0 | 0 | Any 10 bit number |

**Table A.7.4.1.1.1-4: DRX-Configuration for UL Timing Tests.**

| Field | Test 1 |
|---|---|
| | Value |
| drx-onDurationTimer | [ms6] |
| drx-InactivityTimer | [ms1] |
| drx-RetransmissionTimerDL | [sl1] |
| drx-RetransmissionTimerUL | [sl1] |
| longDRX-CycleStartOffset | [ms320] |
| shortDRX | disable |

#### A.7.4.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test:

1) Setup NR PCell according to parameters given in Table A.7.4.1.1.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within ($N_{TA}$ + $N_{TA\_offset}$) ± $T_e$ of the first detected path of DL SSB.

   a. The $N_{TA}$ offset value (in $T_c$ units) is 25600 for FR1 and 13792 for FR2

   b. The $T_e$ values depend on the DL and UL SCS for which the test is being run and are given in Table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in Table A.7.4.1.1.2-1

**Table A.7.4.1.1.2-1 Adjustment Value for DL Timing**

| SCS of SSB signals (KHz) | Adjustment Value | |
|---|---|---|
| | Test1 | Test2 |
| 15 | +64*64$T_c$ | +32*64$T_c$ |
| 30 | +32*64$T_c$ | +16*64$T_c$ |
| 120 | +16*64$T_c$ | +8*64$T_c$ |
| 240 | +8*64$T_c$ | +4*64$T_c$ |

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in Section 7.1.2 Table 7.1.2-3. This will only be done for Test1.

5) The test system shall verify that the UE transmit timing offset stays within ($N_{TA}$ + $N_{TA\_offset}$) ± $T_e$ of the first detected path of DL SSB. For Test 2 and Test 4 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

## A.7.4.2 UE timer accuracy

## A.7.4.3 Timing advance

### A.7.4.3.1 SA FR2 timing advance adjustment accuracy

#### A.7.4.3.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

#### A.7.4.3.1.2 Test Parameters

Supported test configurations are shown in table A.7.4.3.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.7.4.3.1.2-2, A.7.4.3.1.2-3 and A.7.4.3.1.2-4.

In all test cases, single cell is used. Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.7.4.3.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, as specified in Clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to Clause 4.2 in TS 38.213 results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value specified in table A.7.4.3.1.2-2. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in Clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in Clause 5.2 in TS 38.321, shall be configured so that it does not expire in the duration of the test.

**Table A.7.4.3.1.2-1: Timing advance supported test configurations**

| Config | Description |
|---|---|
| 1 | NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

**Table A.7.4.3.1.2-2: General test parameters for timing advance**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF channel number | | 1 | |
| DL BWP | | DLBWP.1.1 | As specified in Table A.3.9.2.1-1 |
| UL BWP | | ULBWP.1.1 | As specified in Table A.3.9.2.2-1 |
| TRS | | TBD | TBD |
| TCI configuration | | TBD | TBD |
| Timing Advance Command ($T_A$) value during T1 | | 31 | $N_{TA\_new} = N_{TA\_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2 |
| Timing Advance Command ($T_A$) value during T2 | | 39 | $N_{TA\_new} = N_{TA\_old} + 8192*T_c$ (based on equation in TS 38.213 [3] section 4.2) |
| T1 | s | 5 | |
| T2 | s | 5 | |

**Table A.7.4.3.1.2-3: Cell specific test parameters for timing advance**

| Parameter | Unit | Test1 | |
|---|---|---|---|
| | | T1 | T2 |

| | | |
|---|---|---|
| Duplex mode | | TDD |
| TDD configuration | | TDDConf.3.1 |
| $BW_{channel}$ | MHz | 100: $N_{RB,c}$ = 66 |
| BWP BW | MHz | 100: $N_{RB,c}$ = 66 |
| DRx Cycle | ms | Not Applicable |
| PDSCH Reference measurement channel | | SR.3.1 TDD |
| CORESET Reference Channel | | CR.3.1 TDD |
| OCNG Patterns | | OCNG pattern 1 |
| SMTC configuration | | SMTC.1 FR2 |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 kHz |
| PUCCH/PUSCH subcarrier spacing | kHz | 120 kHz |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | |
| EPRE ratio of PBCH to PBCH DMRS | | |
| EPRE ratio of PDCCH DMRS to SSS | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | |
| EPRE ratio of PDSCH DMRS to SSS | | |
| EPRE ratio of PDSCH to PDSCH | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | |
| UE orientation around TBD axis and TBD axis | degrees | TBD |
| $N_{oc}$ Note2 | dBm/15kHz | TBD |
| $N_{oc}$ Note2 | dBm/SCS | TBD |
| $\hat{E}_s/I_{ot}$ | dB | TBD |
| $\hat{E}_s/N_{oc}$ | dB | TBD |
| Io Note3 | dBm/ 95.04MHz | TBD |
| Propagation condition | - | AWGN |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone

**Table A.7.4.3.1.2-4: Sounding Reference Symbol Configuration for timing advance**

| Field | Value | Comment |
|---|---|---|
| c-SRS | 16 | Frequency hopping is disabled |
| b-SRS | 0 | |
| b-hop | 0 | |
| freqDomainPosition | 0 | Frequency domain position of SRS |
| freqDomainShift | 0 | |
| groupOrSequenceHopping | neither | No group or sequence hopping |
| SRS-PeriodicityAndOffset | sl5=0 | Once every 5 slots |
| pathlossReferenceRS | ssb-Index=0 | SSB #0 is used for SRS path loss estimation |
| usage | nonCodebook | Non-codebook based UL transmission |
| startPosition | 0 | resourceMapping setting. SRS on last symbol of slot, and 1symbols for SRS without repetition. |
| nrofSymbols | n1 | |
| repetitionFactor | n1 | |
| combOffset-n2 | 0 | transmissionComb setting |
| cyclicShift-n2 | 0 | |
| nrofSRS-Ports | port1 | Number of antenna ports used for SRS transmission |
| Note: For further information see clause 6.3.2 in TS 38.331 [2]. | | |

#### A.7.4.3.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value to the transmission timing at the designated activation time i.e. $k$ slots after the reception of the timing advance command, where $k = 24$.

The Timing Advance adjustment accuracy shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90%.

# A.7.5 Signaling characteristics

## A.7.5.1 Radio link Monitoring

In the following section, any uplink signal transmitted by the UE is used for detecting the In-/Out-of-Sync state of the UE. In terms of measurement, the uplink signal is verified on the basis of the UE output power:

*Editor note: The metric for the detection of the UE UL transmitted signal by the TE is FFS.*

### A.7.5.1.1 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with SSB-based RLM RS in non-DRX mode

#### A.7.5.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

Supported test configurations are shown in table A.7.5.1.1.1-1. The test parameters are given in Tables A.7.5.1.1.1-2, A.7.5.1.1.1-3, and A.7.5.1.1.1-4 below. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.7.5.1.1.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms) in test 2.

*Editor note: whether to revise power level to be gradually changed*

*Editor note: Further to revise the SSB configuration to be 2 SSBs and FFS the corresponding power level of 2nd SSB*

*Editor note: AoA setting needs to be updated.*

*Editor note: test cases may need to be revised for 2 AoA*

**Table A.7.5.1.1.1-1: Supported test configurations for FR2 PCell**

| Configuration | Description |
|---|---|
| 1 | TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100MHz |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

**Table A.7.5.1.1.1-2: General test parameters for FR2 out-of-sync testing in non-DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 1 | Test 2 |
| Active PCell | | | Cell 1 | Cell 1 |
| RF Channel Number | | | 1 | 1 |
| Duplex mode | | | TDD | TDD |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| SSB **Configuration** | Config 1 | | [Table A.3.2.2.2.1-1] | [Table A.3.2.2.2.1-1] |
| SMTC **Configuration** | Config 1 | | Table A.3.2.3.1-1 | Table A.3.2.3.1-1 |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz |
| PRACH Configuration | Config 1 | | TBD | TBD |
| SSB index assigned as RLM RS | Config 1 | | TBD | TBD |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *OFF* | *OFF* |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | TBD | TBD |

| | | | | |
|---|---|---|---|---|
| ZP CSI-RS configuration | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1 | slot | [40] | [40] |
| NZP CSI-RS configuration | | | TBD | TBD |
| ZP CSI-RS configuration | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| T1 | | s | TBD | TBD |
| T2 | | s | TBD | TBD |
| T3 | | s | TBD | TBD |
| D1 | | s | TBD | TBD |
| Note 1: All configurations are assigned to the UE prior to the start of time period T1.<br>Note 2: UE-specific PDCCH is not transmitted after T1 starts. | | | | |

**Table A.7.5.1.1.1-3: OTA related cell specific test parameters for FR2 (Cell 1) for out-of-sync radio link monitoring tests in non-DRX mode**

| Parameter | | Unit | Test 1 | | | Test 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| UE orientation around TBD axis and TBD axis | | degrees | TBD | | | TBD | | |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1 | dB | [1] | [-7] | [-15] | [1] | [-7] | [-15] |
| $N_{oc}$ | | dBm/15 KHz | TBD | | | TBD | | |
| Propagation condition | | | [TDL-A 30ns 75Hz] | | | [TDL-A 30ns 75Hz] | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.7.5.1.1.1-1.<br>Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6]. | | | | | | | | |

**Table A.7.5.1.1.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

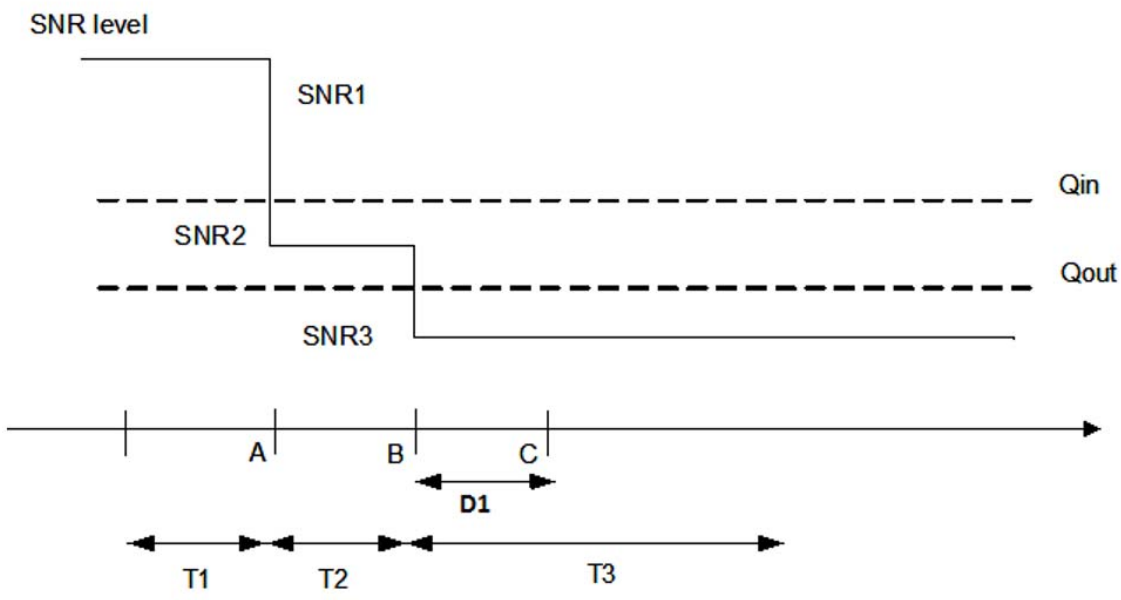


**Figure A.7.5.1.1.1-1: SNR variation for out-of-sync testing**

#### A.7.5.1.1.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

### A.7.5.1.2 Radio Link Monitoring In-sync Test for FR2 PCell configured with SSB-based RLM RS in non-DRX mode

#### A.7.5.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

Supported test configurations are shown in table A.7.5.1.2.1-1.The test parameters are given in Tables A.7.5.1.2.1-2, A.7.5.1.2.1-3, and A.7.5.1.2.1-4 below. There is one cell (Cell 1), which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.1.2.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] ms. UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms) in test 2.

*Editor note: whether to revise power level to be gradually changed*

*Editor note: Further to revise the SSB configuration to be 2 SSBs and FFS the corresponding power levelof the 2nd SSB*

*Editor note: AoA setting needs to be updated.*

*Editor note: test cases may need to be revised for 2 AoA*

**Table A.7.5.1.2.1-1: Supported test configurations for FR2 PCell**

| Configuration | Description |
|---|---|
| 1 | TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100MHz |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

**Table A.7.5.1.2.1-2: General test parameters for FR2 in-sync testing in non-DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 1 | Test 2 |
| Active PCell | | | Cell 1 | Cell 1 |
| RF Channel Number | | | 1 | 1 |
| Duplex mode | | | TDD | TDD |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| SSB **Configuration** | Config 1 | | [Table A.3.2.2.2.1-1] | [Table A.3.2.2.2.1-1] |
| SMTC **Configuration** | Config 1 | | Table A.3.2.3.1-1 | Table A.3.2.3.1-1 |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz |
| PRACH Configuration | Config 1 | | TBD | TBD |
| SSB index assigned as RLM RS | Config 1 | | TBD | TBD |
| OCNG parameters | | | Table A.3.2.1.1-1 | Table A.3.2.1.1-1 |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *OFF* | *OFF* |
| Gap pattern ID | | | [N.A.] | *[*gp0*]* |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | TBD | TBD |

| | | | | |
|---|---|---|---|---|
| ZP CSI-RS configuration | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1 | slot | [40] | [40] |
| NZP CSI-RS configuration | | | TBD | TBD |
| ZP CSI-RS configuration | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| T1 | | s | TBD | TBD |
| T2 | | s | TBD | TBD |
| T3 | | s | TBD | TBD |
| D1 | | s | TBD | TBD |
| Note 1: All configurations are assigned to the UE prior to the start of time period T1.<br>Note 2: UE-specific PDCCH is not transmitted after T1 starts. | | | | |

**Table A.7.5.1.2.1-3: OTA related cell specific test parameters for FR2 (Cell 1) for in-sync radio link monitoring tests in non-DRX mode**

| Parameter | | Unit | Test 1 | | | | | Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| UE orientation around TBD axis and TBD axis | | degrees | TBD | | | | | TBD | | | | |
| PDCCH_beta | | dB | 4 | | | | | 4 | | | | |
| PDCCH_DMRS_beta | | dB | 4 | | | | | 4 | | | | |
| PBCH_beta | | dB | 0 | | | | | 0 | | | | |
| PSS_beta | | dB | | | | | | | | | | |
| SSS_beta | | dB | | | | | | | | | | |
| PDSCH_beta | | dB | | | | | | | | | | |
| OCNG_beta | | dB | | | | | | | | | | |
| SNR | Config 1 | dB | [1] | [-7] | [-15] | [-4.5] | [1] | [1] | [-7] | [-15] | [-4.5] | [1] |
| $N_{oc}$ | | dBm/15 KHz | TBD | | | | | TBD | | | | |
| Propagation condition | | | [TDL-A 30ns 75Hz] | | | | | [TDL-A 30ns 75Hz] | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.7.5.1.2.1-1.<br>Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in section [A.3.6]. | | | | | | | | | | | | |

**Table A.7.5.1.2.1-4: Measurement gap configuration for in-sync tests in non-DRX mode.**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [TBD] |

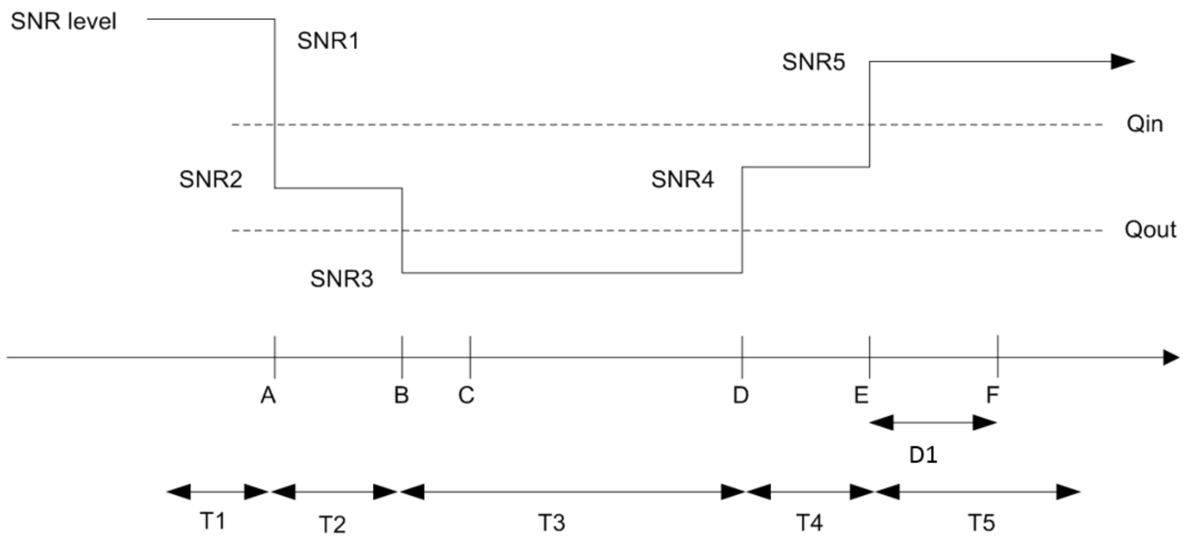


**Figure A.7.5.1.2.1-1: SNR variation for in-sync testing**

#### A.7.5.1.2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

### A.7.5.1.3 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with SSB-based RLM RS in DRX mode

#### A.7.5.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

Supported test configurations are shown in table A.7.5.1.3.1-1. The test parameters are given in Tables A.7.5.1.3.1-2, A.7.5.1.3.1-3, A.7.5.1.3.1-4, and A.7.5.1.3.1-5. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.7.5.1.3.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

*Editor note: whether to revise power level to be gradually changed*

*Editor note: Further to revise the SSB configuration to be 2 SSBs and FFS the corresponding power levelof the 2nd SSB*

*Editor note: AoA setting needs to be updated.*

**Table A.7.5.1.3.1-1: Supported test configurations for FR2 PCell**

| Configuration | Description |
|---|---|
| 1 | TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100MHz |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

**Table A.7.5.1.3.1-2: General test parameters for FR2 out-of-sync testing in DRX mode**

| Parameter | | Unit | Value |
|---|---|---|---|
| | | | Test 1 |
| Active PCell | | | Cell 1 |
| RF Channel Number | | | 1 |
| Duplex mode | | | TDD |
| TDD Configuration | Config 1 | | [TDDConf.3.1] |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] |
| SSB Configuration | Config 1 | | [Table A.3.2.2.2.1-1] |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz |
| SMTC Configuration | Config 1 | | Table A.3.2.3.1-1 |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz |
| PRACH Configuration | Config 1 | | TBD |
| SSB index assigned as RLM RS | Config 1 | | TBD |
| OCNG parameters | | | Table A.3.2.1.1-1 |
| CP length | | | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 |
| | Number of Control OFDM symbols | | 2 |
| | Aggregation level | CCE | 8 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 4 |
| | DMRS precoder granularity | | REG bundle size |
| | REG bundle size | | 6 |
| DRX cycle | | | 640 |
| Gap pattern ID | | | [N.A.] |
| Layer 3 filtering | | | *Enabled* |
| T310 timer | | ms | *0* |
| T311 timer | | ms | 1000 |
| N310z | | | 1 |
| N311 | | | 1 |
| NZP CSI-RS configuration | | | TBD |
| ZP CSI-RS configuration | | | TBD |
| CSI-IM configuration | | | TBD |
| Periodic CSI reporting | | | PUCCH |
| CSI reporting periodicity | Config 1 | slot | [40] |
| NZP CSI-RS configuration | | | TBD |
| ZP CSI-RS configuration | | | TBD |
| CSI-IM configuration | | | TBD |
| T1 | | s | TBD |
| T2 | | s | TBD |
| T3 | | s | TBD |
| D1 | | s | TBD |
| Note 1: All configurations are assigned to the UE prior to the start of time period T1.<br>Note 2: UE-specific PDCCH is not transmitted after T1 starts. | | | |

**Table A.7.5.1.3.1-3: OTA related cell specific test parameters for FR2 (Cell 1) for out-of-sync radio link monitoring tests in DRX mode**

| Parameter | | Unit | Test 1 | | |
|---|---|---|---|---|---|
| | | | T1 | T2 | T3 |
| UE orientation around TBD axis and TBD axis | | degrees | TBD | | |
| PDCCH_beta | | dB | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | |
| PBCH_beta | | dB | 0 | | |
| PSS_beta | | dB | | | |
| SSS_beta | | dB | | | |
| PDSCH_beta | | dB | | | |
| OCNG_beta | | dB | | | |
| SNR | Config 1 | dB | [1] | [-7] | [-15] |
| $N_{oc}$ | | dBm/15 KHz | TBD | | |
| Propagation condition | | | [TDL-A 30ns 75Hz] | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.7.5.1.3.1-1.<br>Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6]. | | | | | |

**Table A.7.5.1.3.1-4: DRX-Configuration for out-of-sync tests**

| Field | Test 1 |
|---|---|
| | Value |
| drx-onDurationTimer | [ms6] |
| drx-InactivityTimer | [ms1] |
| drx-RetransmissionTimerDL | [sl1] |
| drx-RetransmissionTimerUL | [sl1] |
| drx-LongCycle | [ms640] |
| drx-StartOffset | [ms0] |
| shortDRX | disable |

**Table A.7.5.1.3.1-5: TimeAlignmentTimer -Configuration for out-of-sync testing**

| Field | Test1 |
|---|---|
| | Value |
| TimeAlignmentTimer | [Infinity] |
| periodicityAndOffset in SchedulingRequestResourceConfig | [sl40] |

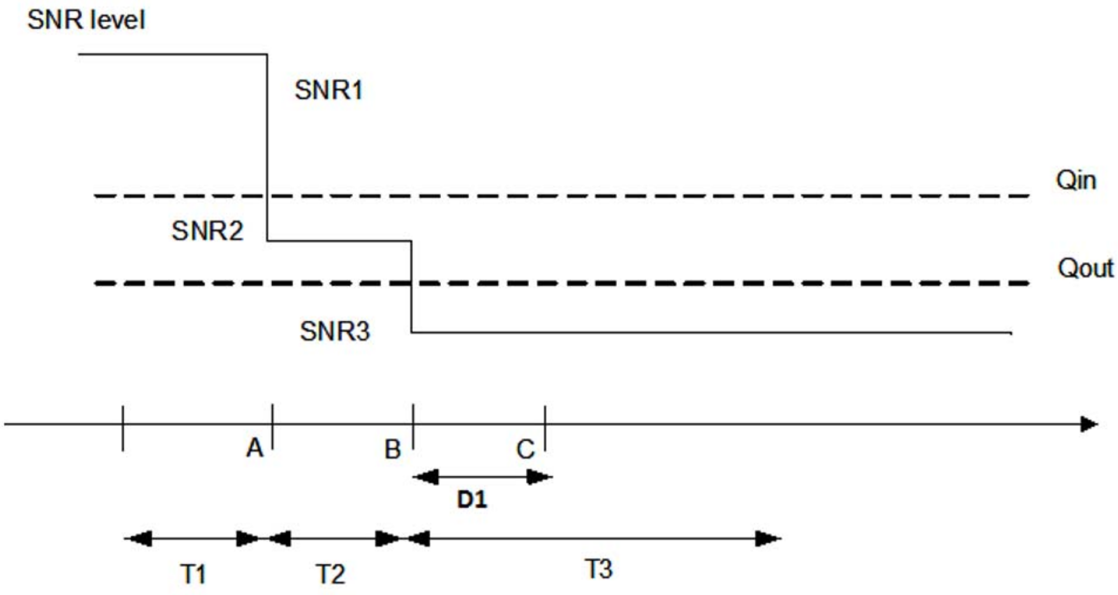


**Figure A.7.5.1.3.1-1: SNR variation for out-of-sync testing**

#### A.7.5.1.3.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

### A.7.5.1.4 Radio Link Monitoring In-sync Test for FR2 PCell configured with SSB-based RLM RS in DRX mode

#### A.7.5.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

Supported test configurations are shown in table A.7.5.1.4.1-1. The test parameters are given in Tables A.7.5.1.4.1-2, A.7.5.1.4.1-3, A.7.5.1.4.1-4, and A.7.5.1.4.1-5. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.1.4.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [5] ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

*Editor note: whether to revise power level to be gradually changed*

*Editor note: Further to revise the SSB configuration to be 2 SSBs and FFS the corresponding power levelof 2nd SSB*

*Editor note: AoA setting needs to be updated.*

**Table A.7.5.1.4.1-1: Supported test configurations for FR2 PCell**

| Configuration | Description |
|---|---|
| 1 | TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100MHz |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

**Table A.7.5.1.4.1-2: General test parameters for FR2 in-sync testing in DRX mode**

| Parameter | | Unit | Value<br>Test 1 |
|---|---|---|---|
| Active PCell | | | Cell 1 |
| RF Channel Number | | | 1 |
| Duplex mode | | | TDD |
| TDD Configuration | Config 1 | | [TDDConf.3.1] |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] |
| SSB **Configuration** | Config 1 | | [Table A.3.2.2.2.1-1] |
| SMTC **Configuration** | Config 1 | | Table A.3.2.3.1-1 |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz |
| PRACH Configuration | Config 1 | | TBD |
| SSB index assigned as RLM RS | Config 1 | | TBD |
| OCNG parameters | | | Table A.3.2.1.1-1 |
| CP length | | | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] |
| In sync transmission parameters | DCI format | | 1-0 |
| | Number of Control OFDM symbols | | 2 |
| | Aggregation level | CCE | 4 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 0 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 0 |
| | DMRS precoder granularity | | REG bundle size |
| | REG bundle size | | 6 |
| Out of sync transmission parameters | DCI format | | 1-0 |
| | Number of Control OFDM symbols | | 2 |
| | Aggregation level | CCE | 8 |
| | Ratio of hypothetical PDCCH RE energy to average SSS RE energy | dB | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy | dB | 4 |
| | DMRS precoder granularity | | REG bundle size |
| | REG bundle size | | 6 |
| DRX cycle | | ms | 40 |
| Gap pattern ID | | | [N.A.] |
| Layer 3 filtering | | | *Enabled* |
| NZP CSI-RS configuration | | | TBD |
| ZP CSI-RS configuration | | | TBD |
| CSI-IM configuration | | | TBD |
| Periodic CSI reporting | | | PUCCH |
| CSI reporting periodicity | Config 1 | slot | [40] |

| | | |
|---|---|---|
| NZP CSI-RS configuration | | TBD |
| ZP CSI-RS configuration | | TBD |
| CSI-IM configuration | | TBD |
| T1 | s | TBD |
| T2 | s | TBD |
| T3 | s | TBD |
| T4 | s | TBD |
| T5 | s | TBD |
| D1 | s | TBD |
| Note 1: All configurations are assigned to the UE prior to the start of time period T1.<br>Note 2: UE-specific PDCCH is not transmitted after T1 starts. | | |

**Table A.7.5.1.4.1-3: OTA related cell specific test parameters for FR2 (Cell 1) for in-sync radio link monitoring test in DRX mode**

| Parameter | | Unit | Test 1 | | | | |
|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T4 | T5 |
| UE orientation around TBD axis and TBD axis | | degrees | TBD | | | | |
| PDCCH_beta | | dB | 4 | | | | |
| PDCCH_DMRS_beta | | dB | 4 | | | | |
| PBCH_beta | | dB | 0 | | | | |
| PSS_beta | | dB | | | | | |
| SSS_beta | | dB | | | | | |
| PDSCH_beta | | dB | | | | | |
| OCNG_beta | | dB | | | | | |
| SNR | Config 1 | dB | [1] | [-7] | [-15] | [-4.5] | [1] |
| $N_{oc}$ | | dBm/15 KHz | TBD | | | | |
| Propagation condition | | | [TDL-A 30ns 75Hz] | | | | |
| Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.<br>Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.<br>Note 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.7.5.1.4.1-1.Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in section [A.3.6]. | | | | | | | |

**Table A.7.5.1.4.1-4: DRX-Configuration for in-sync tests**

| Field | Test 1 |
|---|---|
| | Value |
| drx-onDurationTimer | [ms6] |
| drx-InactivityTimer | [ms1] |
| drx-RetransmissionTimerDL | [sl1] |
| drx-RetransmissionTimerUL | [sl1] |
| drx-LongCycle | [ms40] |
| drx-StartOffset | [ms0] |
| shortDRX | disable |

**Table A.7.5.1.4.1-5: TimeAlignmentTimer -Configuration for in-sync testing**

| Field | Test 1 |
|---|---|
| | Value |
| TimeAlignmentTimer | infinity |
| periodicityAndOffset in SchedulingRequestResourceConfig | [sl40] |

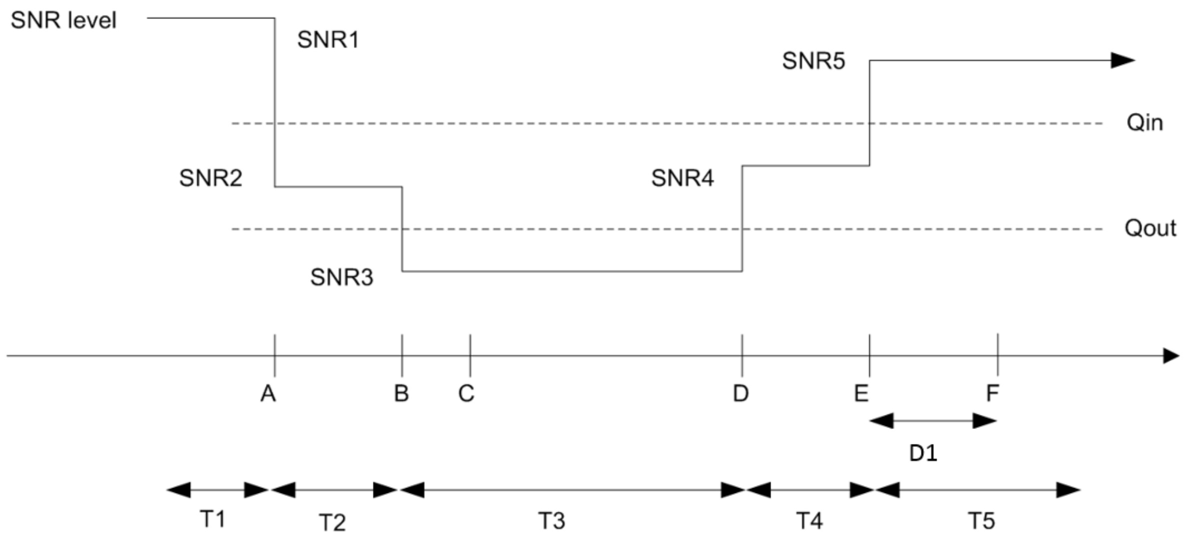


**Figure A.7.5.1.4.1-1: SNR variation for in-sync testing**

#### A.7.5.1.4.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

### A.7.5.1.5 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with CSI-RS-based RLM in non-DRX mode

#### A.7.5.1.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR2 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.7.5.1.5.1-1, A.7.5.1.5.1-2, and A.7.5.1.5.1-3 below. There is one cell, cell 1 which is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.7.5.1.5.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [10] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test2.

**Table A.7.5.1.5.1-1: Supported test configurations for FR2 PCell**

| Configuration | Description |
|---|---|
| 1 | TDD duplex mode, 120 kHz SSB SCS, 100MHz bandwidth |

**Table A.7.5.1.5.1-2: General test parameters for FR2 PCell for CSI-RS out-of-sync testing in non-DRX mode**

| Parameter | | Unit | Value Test 1 | Value Test 2 |
|---|---|---|---|---|
| Active PCell | | | Cell 1 | Cell 1 |
| RF Channel Number | | | 1 | 1 |
| Duplex mode | Config 1 | | TDD | TDD |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| SMTC Configuration | Config 1 | | TDD | TDD |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *OFF* | *OFF* |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1 | slot | [10] | [10] |
| T1 | | s | 1 | 1 |
| T2 | | s | 0.4 | 0.4 |
| T3 | | s | [0.6] | [0.6] |
| D1 | | s | [0.24] | [0.44] |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | |

**Table A.7.5.1.5.1-3: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in non-DRX mode**

| Parameter | | Unit | Test 1 | | | Test 2 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | [-98] | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | [TDL-C 300ns 100Hz] | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.1.5.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.7.5.1.5.1-3: Measurement gap configuration for FR2 CSI-RS out-of-sync radio link monitoring in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

Note 1: RLM RS is partially overlapped with measurement gap

**Table A.7.5.1.5.1-4: NZP-CSI-RS resource configuration for FR2 CSI-RS out-of-sync radio link monitoring in non-DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation Note 2 | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |

Note 1: TS 38.211 [6] table 7.4.1.5.3-1
Note 2: nrofRBs is derived based on the Configuration in Table A.7.5.1.5.1-1

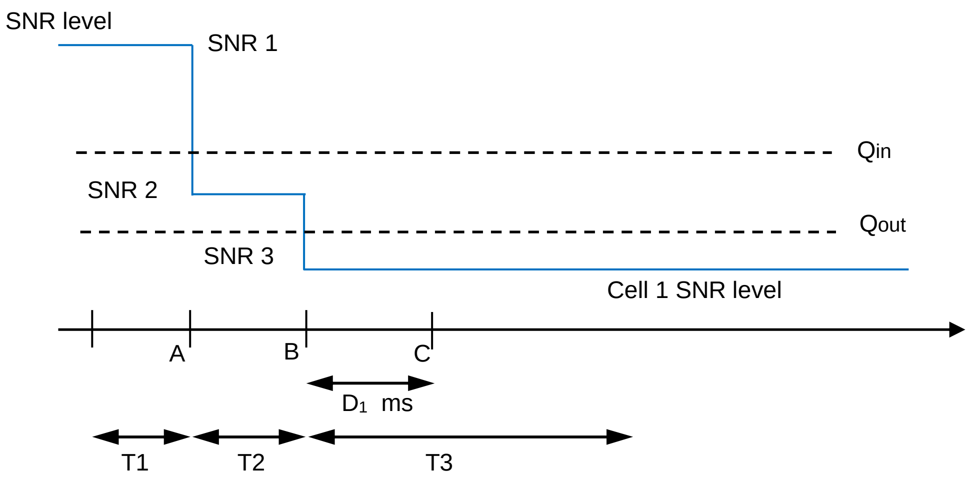


**Figure A.7.5.1.5.1-1: SNR variation for CSI-RS out-of-sync testing**

#### A.7.5.1.5.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 no later than time point C ($D_1$ = [TBD] ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

### A.7.5.1.6 Radio Link Monitoring In-sync Test for FR2 PCell configured with CSI-RS-based RLM in non-DRX mode

#### A.7.5.1.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR2 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.7.5.1.6.1-1, A.7.5.1.6.1-2, A.7.5.1.6.1-3, A.7.5.1.6.1-4, A.7.5.1.6.1-5, and A.7.5.1.6.1-6 below. There is one cells, cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.1.6.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [10] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 4.

**Table A.7.5.1.6.1-1: Supported test configurations for FR2 PCell**

| Configuration | Description |
|---|---|
| 1 | TDD duplex mode, 120 kHz SSB SCS, 100MHz bandwidth |

**Table A.7.5.1.6.1-2: General test parameters for FR2 PCell for CSI-RS in-sync testing in non-DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 3 | Test 4 |
| Active PCell | | | Cell 1 | Cell 1 |
| RF Channel Number | | | 1 | 1 |
| Duplex mode | Config 1 | | TDD | TDD |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| SMTC Configuration | Config 1 | | TDD | TDD |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| In sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 4 | 4 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *OFF* | *OFF* |
| Gap pattern ID | | | [N.A.] | *[*gp0*]* |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |

| | | | | |
|---|---|---|---|---|
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1 | slot | [10] | [10] |
| T1 | | s | 1 | 1 |
| T2 | | s | 0.4 | 0.4 |
| T3 | | s | [0.6] | [0.6] |
| D1 | | s | [0.24] | [0.44] |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | |

**Table A.7.5.1.6.1-3: Cell specific test parameters for FR2 for CSI-RS in-sync radio link monitoring in non-DRX mode**

| Parameter | | Unit | Test 3 | | | Test 4 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | [-98] | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | [TDL-C 300ns 100Hz] | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.1.6.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.7.5.1.6.1-3: Measurement gap configuration for FR2 CSI-RS in-sync radio link monitoring in non-DRX mode**

| Field | Test 4 |
|---|---|
| | Value |
| gapOffset | [0] |
| Note 1: RLM RS is partially overlapped with measurement gap | |

**Table A.7.5.1.6.1-4: NZP-CSI-RS resource configuration for FR2 CSI-RS in-sync radio link monitoring in non-DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation Note 2 | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.4.7.1.6.1-1 | | |

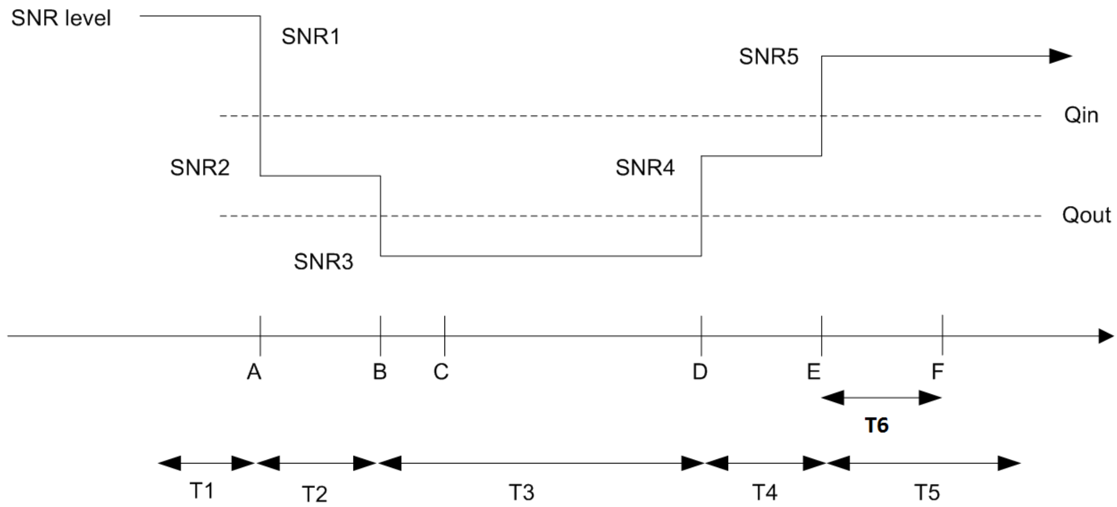


**Figure A.7.5.1.6.1-1: SNR variation for CSI-RS in-sync testing**

### A.7.5.1.6.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

## A.7.5.1.7 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with CSI-RS-based RLM in DRX mode

### A.7.5.1.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR2 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.7.5.1.7.1-1, A.7.5.1.7.1-2, and A.7.5.1.7.1-3 below. There is one cell, cell 1 is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.7.5.1.7.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [10] ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 6.

**Table A.7.5.1.7.1-1: Supported test configurations for FR2 PCell**

| Configuration | Description |
|---|---|
| 1 | TDD duplex mode, 120 kHz SSB SCS, 100MHz bandwidth |

**Table A.7.5.1.7.1-2: General test parameters for FR2 PCell for CSI-RS out-of-sync testing in DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | **Test 5** | **Test 6** |
| Active PCell | | | Cell 1 | Cell 1 |
| RF Channel Number | | | 1 | 1 |
| Duplex mode | Config 1 | | TDD | TDD |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| SMTC Configuration | Config 1 | | TDD | TDD |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | *640* | *640* |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1 | slot | [10] | [10] |
| T1 | | s | 1 | 1 |
| T2 | | s | 0.4 | 0.4 |
| T3 | | s | [0.6] | [0.6] |
| D1 | | s | [0.24] | [0.44] |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | |

**Table A.7.5.1.7.1-3: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in DRX mode**

| Parameter | | Unit | Test 5 | | | Test 6 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | [-98] | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | [TDL-C 300ns 100Hz] | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.1.7.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.7.5.1.7.1-3: Measurement gap configuration for FR2 CSI-RS out-of-sync radio link monitoring in DRX mode**

| Field | Test 6 |
|---|---|
| | Value |
| gapOffset | [0] |

Note 1: RLM RS is partially overlapped with measurement gap

**Table A.7.5.1.7.1-4: NZP-CSI-RS resource configuration for FR2 CSI-RS out-of-sync radio link monitoring in DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation Note 1 | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |

Note 1: TS 38.211 [6] table 7.4.1.5.3-1
Note 2: nrofRBs is derived based on the Configuration in Table A.7.5.1.7.1-1

**Table A.7.5.1.7.1-5: DRX-Configuration for FR2 CSI-RS out-of-sync radio link monitoring in DRX mode.**

| Field | Test 5 | Test 6 |
|---|---|---|
| | Value | Value |
| drx-onDurationTimer | [ms6] | [ms6] |
| drx-InactivityTimer | [ms1] | [ms1] |
| drx-RetransmissionTimerDL | [sl1] | [sl1] |
| drx-RetransmissionTimerUL | [sl1] | [sl1] |
| longDRX-CycleStartOffset | [ms640] | [ms40] |
| shortDRX | disable | disable |

**Table A.7.5.1.7.1-6: TimeAlignmentTimer -Configuration for FR2 CSI-RS out-of-sync radio link monitoring in DRX mode.**

| Field | | Test 5 | Test 6 |
|---|---|---|---|
| | | Value | Value |
| TimeAlignmentTimer | | infinity | infinity |
| periodicityAndOffset in SchedulingRequestResourceConfig | Config 1 | [sl5] | [sl5] |

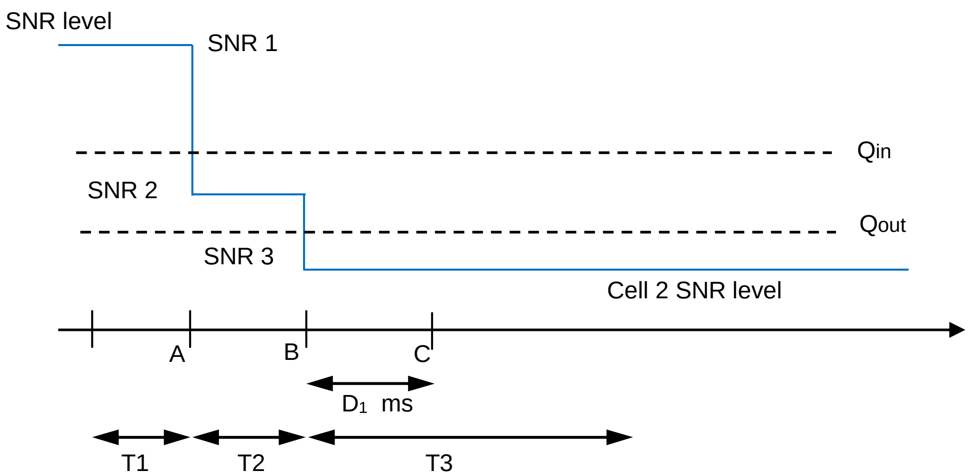


**Figure A.7.5.1.7.1-1: SNR variation for CSI-RS out-of-sync testing**

## A.7.5.1.7.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on PCell.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 (PCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 (PCell) no later than time point C ($D_1$ = [TBD] ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

### A.7.5.1.8 Radio Link Monitoring In-sync Test for FR2 PCell configured with CSI-RS-based RLM in DRX mode

#### A.7.5.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR2 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.7.5.1.8.1-1, A.7.5.1.81-2, A.7.5.1.8.1-3 and A.7.5.1.8.1-4 below. There is one cells, cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.1.8.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [10] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 7.

**Table A.7.5.1.8.1-1: Supported test configurations for FR2 PSCell**

| Configuration | Description |
|---|---|
| 1 | TDD duplex mode, 120 kHz SSB SCS, 100MHz bandwidth |

**Table A.7.5.1.8.1-2: General test parameters for FR2 PCell for CSI-RS in-sync testing in non-DRX mode**

| Parameter | | Unit | Value | |
|---|---|---|---|---|
| | | | Test 7 | Test 8 |
| Active PCell | | | Cell 1 | Cell 1 |
| RF Channel Number | | | 1 | 1 |
| Duplex mode | Config 1 | | TDD | TDD |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) |
| SMTC Configuration | Config 1 | | TDD | TDD |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] |
| OCNG parameters | | | TBD | TBD |
| CP length | | | Normal | Normal |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] |
| Out of sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 8 | 8 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 4 | 4 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 4 | 4 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| In sync transmission parameters | DCI format | | 1-0 | 1-0 |
| | Number of Control OFDM symbols | | 2 | 2 |
| | Aggregation level | CCE | 4 | 4 |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 |
| | DMRS precoder granularity | | REG bundle size | REG bundle size |
| | REG bundle size | | 6 | 6 |
| DRX | | | 640 | 640 |
| Gap pattern ID | | | [N.A.] | *[*gp0*] |
| Layer 3 filtering | | | *Enabled* | *Enabled* |
| T310 timer | | ms | *0* | *0* |
| T311 timer | | ms | 1000 | 1000 |
| N310 | | | 1 | 1 |

| | | | | |
|---|---|---|---|---|
| N311 | | | 1 | 1 |
| NZP CSI-RS configuration | | | [ResourceId 1] | [ResourceId 0] |
| ZP CSI-RS configuation | | | TBD | TBD |
| CSI-IM configuration | | | TBD | TBD |
| Periodic CSI reporting | | | PUCCH | PUCCH |
| CSI reporting periodicity | Config 1 | slot | [10] | [10] |
| T1 | | s | 1 | 1 |
| T2 | | s | 0.4 | 0.4 |
| T3 | | s | [0.6] | [0.6] |
| D1 | | s | [0.24] | [0.44] |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | |

**Table A.7.5.1.8.1-3: Cell specific test parameters for FR2 for CSI-RS in-sync radio link monitoring in non-DRX mode**

| Parameter | | Unit | Test 7 | | | Test 8 | | |
|---|---|---|---|---|---|---|---|---|
| | | | T1 | T2 | T3 | T1 | T2 | T3 |
| PDCCH_beta | | dB | 4 | | | 4 | | |
| PDCCH_DMRS_beta | | dB | 4 | | | 4 | | |
| PBCH_beta | | dB | 0 | | | 0 | | |
| PSS_beta | | dB | | | | | | |
| SSS_beta | | dB | | | | | | |
| PDSCH_beta | | dB | | | | | | |
| OCNG_beta | | dB | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | [-98] | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | [TDL-C 300ns 100Hz] | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.1.8.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.7.5.1.8.1-3: Measurement gap configuration for FR2 CSI-RS in-sync radio link monitoring in non-DRX mode**

| Field | Test 8 |
|---|---|
| | Value |
| gapOffset | [0] |
| Note 1: RLM RS is partially overlapped with measurement gap | |

**Table A.7.5.1.8.1-4: NZP-CSI-RS resource configuration for FR2 CSI-RS in-sync radio link monitoring in non-DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation[Note 1] | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.7.5.1.8.1-1 | | |

**Table A.7.5.1.8.1-5: DRX-Configuration for FR2 CSI-RS in-sync radio link monitoring in DRX mode.**

| Field | Test 5 | Test 6 |
|---|---|---|
| | Value | Value |
| drx-onDurationTimer | [ms6] | [ms6] |
| drx-InactivityTimer | [ms1] | [ms1] |
| drx-RetransmissionTimerDL | [sl1] | [sl1] |
| drx-RetransmissionTimerUL | [sl1] | [sl1] |
| longDRX-CycleStartOffset | [ms640] | [ms40] |
| shortDRX | disable | disable |

**Table A.7.5.1.8.1-6: TimeAlignmentTimer -Configuration for FR2 CSI-RS in-sync radio link monitoring in DRX mode**

| Field | | Test 5 | Test 6 |
|---|---|---|---|
| | | Value | Value |
| TimeAlignmentTimer | | infinity | infinity |
| periodicityAndOffset in SchedulingRequestResourceConfig | Config 1 | [sl5] | [sl5] |

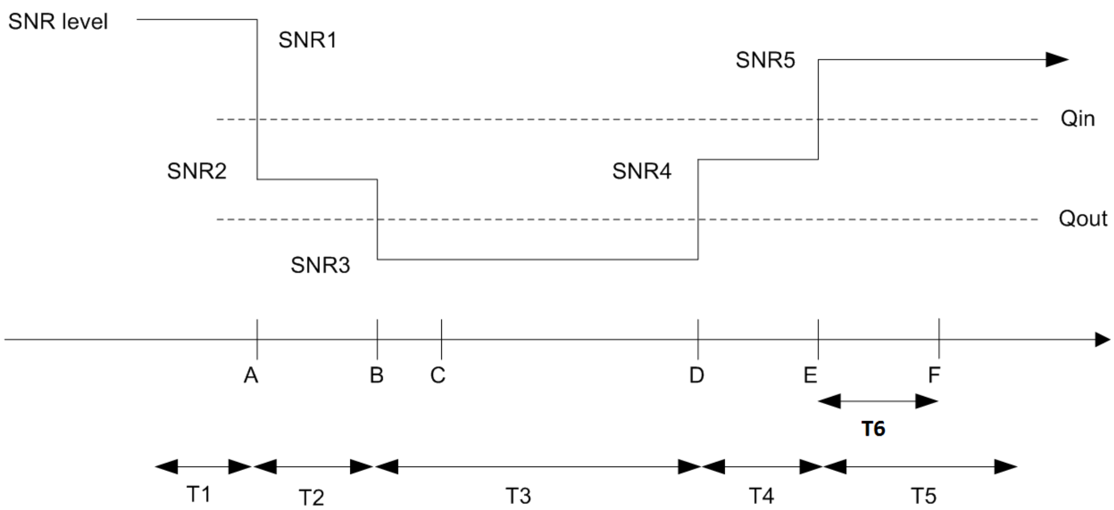


**Figure A.7.5.1.8.1-1: SNR variation for CSI-RS in-sync testing**

#### A.7.5.1.8.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

## A.7.5.2 Interruption

## A.7.5.3 SCell Activation and Deactivation Delay

### A.7.5.3.1 SCell Activation and deactivation for FR2 SCell with the active serving cell in the same FR2 band

#### A.7.5.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in section 8.3, when the SCell in FR2 and the active serving cell is in the same FR2 band.

The supported test configurations are shown in table A.7.5.3.1.1-1 below. The general test parameters are the same as defined in Tables A.7.5.3.1.1-2, and cell specific test parameters are described in Tables A.7.5.3.1.1-3. OTA related test parameters are shown in table A.7.5.3.1.1-4 below. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There is one NR carrier with two cells. Both cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1, but is not aware of Cell2. The UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on radio channel 2. The UE now starts monitoring the SCC. The test equipment sends a MAC message for activation of the SCell.

The point in time at which the MAC message is received, in slot # denoted n, defines the start of time period T2. The UE shall be able to report valid CSI in PCell for the activated SCell at latest in slot ($n+T_{HARQ}+T_{activation\_time}+T_{CSI\_Reporting}$), as defined in section 8.3. The UE shall start reporting CSI in PCell in slot ($n+ T_{HARQ}+3ms$) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell interruption due to activation of SCell shall occur in the slot ($n+1+ [T_{HARQ}] +3ms$) to ($n+1+ [T_{HARQ}+3ms+T_{SSB\_max}+T_{SMTC\_duration}]$), as defined in section 8.3.

Time period T3 starts when a MAC message for deactivation of SCell is received at a slot # denoted m. The UE shall carry out deactivation of the SCell in a slot ($m+[T_{HARQ}+3ms]$), as defined in section 8.3, and any PCell interruption due to the deactivation shall occur in the slot ($m+1+[T_{HARQ}]$) to ($m+1+[T_{HARQ}+3ms]$), as defined in section 8.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for SCell is discontinued.

**Table A.7.5.3.1.1-1: Supported test configurations for FR2 SCell activation case**

| Configuration | Description |
|---|---|
| 1 | NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations | |

**Table A.7.5.3.1.1-2: General test parameters for FR2 SCell activation case**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| RF Channel Number | | 1 | One NR radio channel are used for this test |
| Active PCell | | Cell 1 | Primary cell on NR RF channel number 1. |
| Configured deactivated SCell | | Cell 2 | Configured deactivated secondary cell on NR RF channel number 1 |
| CP length | | Normal | |
| DRX | | OFF | Continuous monitoring of primary cell |
| CQI/PMI periodicity and offset configuration index | | 0 | CQI reporting for SCell every second subframe |
| Cell-individual offset for cells on NR channel number | dB | 0 | Individual offset for cells on primary component carrier. |
| SCell measurement cycle (measCycleSCell) | ms | 160 | |
| Cell2 timing offset to cell1 | µs | 0 | |
| Time alignment error between cell2 and cell1 | µs | ≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1. | The value of time alignment error depends upon the type of carrier aggregation. |
| T1 | s | [7] | During this time the PSCell shall be known and the SCell configured and detected. |
| T2 | s | [1] | During this time the UE shall activate the SCell. |
| T3 | s | [1] | During this time the UE shall deactivate the SCell. |
| $T_{HARQ}$ | ms | k | k is the number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format specified in 38.213 |
| $T_{CSI\_Reporting}$ | ms | [2] | the delay including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources as specified in 38.331 [2] |

**Table A.7.5.3.1.1-3: Cell specific test parameters for FR2 SCell activation case**

| Parameter Note 5 | Unit | T1 | | T2 | | T3 | |
|---|---|---|---|---|---|---|---|
| | | Cell 1 | Cell 2 | Cell 1 | Cell 2 | Cell 1 | Cell 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SSB ARFCN | | freq2 | | freq2 | | freq2 | |
| Duplex mode | | TDD | | TDD | | TDD | |
| TDD configuration | | TDDConf.3.1 | | TDDConf.3.1 | | TDDConf.3.1 | |
| Initial BWP Configuration | | TBD | | TBD | | TBD | |
| $BW_{channel}$ | MHz | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| PDSCH Reference measurement channel | | SR.3.1 TDD | - | SR.3.1 TDD | - | SR.3.1 TDD | - |
| RMSI CORESET Parameters | | CR.3.1 TDD | - | CR.3.1 TDD | - | CR.3.1 TDD | - |
| RMC CORESET Parameters | | CCR.3.1 TDD | - | CCR.3.1 TDD | - | CCR.3.1 TDD | - |
| OCNG Patterns | | OP.1 | | | | | |
| SSB Configuration | | SSB.1 FR2 | | | | | |
| SMTC Configuration | | SMTC.1 FR2 | | | | | |
| EPRE ratio of PSS to SSS | dB | 0 | | | | | |
| EPRE ratio of PBCH_DMRS to SSS | | | | | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | | | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | | | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | | | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | | | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS Note 1 | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 | | | | | | | |
| $\hat{E}_s/N_{oc}$ | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| Propagation conditions | | AWGN | | | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 5: All parameters apply for configuration 1 and 2 | | | | | | | |

**Table A.7.5.3.1.1-4: OTA related test parameters for FR2 SCell activation case**

| Parameter | | Unit | T1 | | T2 | | T3 | |
|---|---|---|---|---|---|---|---|---|
| | | | Cell 1 | Cell 2 | Cell 1 | Cell 2 | Cell 1 | Cell 2 |
| Angle of arrival configuration | | | According to table A.X.X | | According to table A.X.X | | According to table A.X.X | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/15kHz | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | | |
| | NR_TDD_FR2_F | | | | | | | |
| | NR_TDD_FR2_G | | | | | | | |
| | NR_TDD_FR2_T | | | | | | | |
| | NR_TDD_FR2_Y | | | | | | | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/SCS | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | | |
| | NR_TDD_FR2_F | | | | | | | |
| | NR_TDD_FR2_G | | | | | | | |
| | NR_TDD_FR2_T | | | | | | | |
| | NR_TDD_FR2_Y | | | | | | | |
| SS-RSRP Note2 | NR_TDD_FR2_A | dBm/SCS Note3 | TBD | TBD | TBD | TBD | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | | |
| | NR_TDD_FR2_F | | | | | | | |
| | NR_TDD_FR2_G | | | | | | | |
| | NR_TDD_FR2_T | | | | | | | |
| | NR_TDD_FR2_Y | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\hat{E}_s/I_{ot}$ | | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| Io[Note2] | NR_TDD_FR2_A<br>NR_TDD_FR2_B<br>NR_TDD_FR2_F<br>NR_TDD_FR2_G<br>NR_TDD_FR2_T<br>NR_TDD_FR2_Y | dBm/95.04 MHz [Note4] | TBD | | TBD | | TBD | |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone | | | | | | | | |

#### A.7.5.3.1.2 Test Requirements

The test requirements defined in section A.6.5.3.1.2 shall apply to this test case, except $T_{activation\_time}$ will be replaced with the value [5ms+ $T_{SMTC\_SCell}$] as defined in section 8.3.

### A.7.5.3.2 SCell Activation and deactivation for FR2 SCell with no active serving cell in the same FR2 band

#### A.7.5.3.2.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in section A.7.5.3.1.1 except the PCell is in FR1 and SCell is in FR2.

The supported test configurations are the same as defined in Table A.7.5.3.2.1-1. The general test parameters are the same as defined in Table A.6.5.3.1.1-2. And cell specific test parameters are described in Tables A.7.5.3.2.1-2. OTA related test parameters are the same as defined in Table A.7.5.3.1.1-4.

**Table A.7.5.3.2.1-1: Supported test configurations for FR2 SCell activation case**

| Configuration | Description |
|---|---|
| 1 | PCell: 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode<br>Target SCell: 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | PCell: 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode<br>Target SCell: 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 3 | PCell: 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode<br>Target SCell: 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to pass in one of the supported test configurations | |

**Table A.7.5.3.2.1-2: Cell specific test parameters for FR2 SCell activation case**

| Parameter[Note 5] | Unit | T1 | | T2 | | T3 | |
|---|---|---|---|---|---|---|---|
| | | Cell 1 | Cell 2 | Cell 1 | Cell 2 | Cell 1 | Cell 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SSB ARFCN | | | Freq1 | Freq2 | Freq1 | Freq2 | Freq1 | Freq2 |
| Duplex mode | Config 1 | | FDD | TDD | FDD | TDD | FDD | TDD |
| | Config 2,3 | | TDD | | | | | |
| TDD configuration | Config 1 | | Not Applicable | TDDConf.3.1 | Not Applicable | TDDConf.3.1 | Not Applicable | TDDConf.3.1 |
| | Config 2,3 | | TDDConf.1.1 | | TDDConf.1.1 | | TDDConf.1.1 | |
| Initial BWP Configuration | Config 1,2,3 | | DLBWP.0 | | | | | |
| $BW_{channel}$ | Config 1,2 | MHz | 10: $N_{RB,c}$ = 52 | 100: $N_{RB,c}$ = 66 | 10: $N_{RB,c}$ = 52 | 100: $N_{RB,c}$ = 66 | 10: $N_{RB,c}$ = 52 | 100: $N_{RB,c}$ = 66 |
| | Config 3 | | 40: $N_{RB,c}$ = 106 | | 40: $N_{RB,c}$ = 106 | | 40: $N_{RB,c}$ = 106 | |
| PDSCH Reference measurement channel | Config 1 | | SR.1.1 FDD | - | SR.1.1 FDD | - | SR.1.1 FDD | - |
| | Config 2 | | SR.1.1 TDD | | SR.1.1 TDD | | SR.1.1 TDD | |
| | Config 3 | | SR.2.1 TDD | | SR.2.1 TDD | | SR.2.1 TDD | |
| RMSI CORESET Parameters | Config 1 | | CR.1.1 FDD | - | CR.1.1 FDD | - | CR.1.1 FDD | - |
| | Config 2 | | CR.1.1 TDD | | CR.1.1 TDD | | CR.1.1 TDD | |
| | Config 3 | | CR.2.1 TDD | | CR.2.1 TDD | | CR.2.1 TDD | |
| RMC CORESET Parameters | Config 1 | | CCR.1.1 FDD | - | CCR.1.1 FDD | - | CCR.1.1 FDD | - |
| | Config 2 | | CCR.1.1 TDD | | CCR.1.1 TDD | | CCR.1.1 TDD | |
| | Config 3 | | CCR.2.1 TDD | | CCR.2.1 TDD | | CCR.2.1 TDD | |
| OCNG Patterns | | | OP.1 | | | | | |
| SSB configuration | Config 1,2 | | SSB.1 FR1 | SSB.3 FR2 | SSB.1 FR1 | SSB.3 FR2 | SSB.1 FR1 | SSB.3 FR2 |
| | Config 3 | | SSB.2 FR1 | | SSB.2 FR1 | | SSB.2 FR1 | |
| SMTC configuration | | | SMTC.1 | | | | | |
| EPRE ratio of PSS to SSS | | dB | 0 | | | | | |
| EPRE ratio of PBCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PBCH to PBCH_DMRS | | | | | | | | |
| EPRE ratio of PDCCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH_DMRS | | | | | | | | |
| EPRE ratio of PDSCH_DMRS to SSS | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH_DMRS | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS Note 1 | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 | | | | | | | | |
| $\hat{E}_s/N_{oc}$ | | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| Propagation conditions | | | AWGN | | | | | |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: All parameters apply for configuration 1 and 2

#### A.7.5.3.2.2 Test Requirements

The test requirements defined in section A.7.5.3.1.2 shall apply to this test case, except $T_{activation\_time}$ will be replaced with the value [TBD*$T_{SMTC\_SCell}$ +5ms] as defined in section 8.3.

## A.7.5.4 UE UL carrier RRC reconfiguration Delay

## A.7.5.5 Beam Failure Detection and Link recovery procedures

### A.7.5.5.1 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with SSB-based BFD and LR in non-DRX mode

*Editor's note: It is open whether BFD can be based on SSB. This test case will be updated accordingly.*

#### A.7.5.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set $q_0$ configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candicate set $q_1$. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.7.5.5.1.1-1, A.7.5.5.1.1-2, A.7.5.5.1.1-3 and A.7.5.5.1.1-4 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.1.1-1 shows the variation of the downlink SNR of the SSB in set $q_0$ in the active cell to emulate SSB based beam failure. Figure A.7.5.5.1.1-1 additionally shows the variation of the downlink SNR of the SSB in set $q_1$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 2.

**Table A.7.5.5.1.1-1: Supported test configurations for FR2 PCell**

| Configuration | Description |
|---|---|
| 1 | TDD duplex mode, 120 kHz SSB SCS, 100MHz bandwidth |
| 2 | TDD duplex mode, 240 kHz SSB SCS, 100MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

**Table A.7.5.5.1.1-2: General test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode**

| Parameter | | Unit | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active PCell | | | Cell 1 | Cell 1 | |
| RF Channel Number | | | 1 | 1 | |
| Duplex mode | Config 1 | | TDD | TDD | |
| | Config 2 | | TDD | TDD | |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] | |
| | Config 2 | | [TDDConf.3.1] | [TDDConf.3.1] | |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] | |
| | Config 2 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] | |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| | Config 2 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| SMTC Configuration | Config 1 | | TDD | TDD | |
| | Config 2 | | TDD | TDD | |
| PDSCH/ PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz | |
| | Config 2 | | 120 KHz | 120 KHz | |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] | |
| OCNG parameters | | | TBD | TBD | |
| CP length | | | Normal | Normal | |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] | |
| Beam failure detection trans mission parameters | DCI format | | 1-0 | 1-0 | |
| | Number of Control OFDM symbols | | 2 | 2 | |
| | Aggregation level | CCE | 8 | 8 | |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | DMRS precoder granularity | | REG bundle size | REG bundle size | |
| | REG bundle size | | 6 | 6 | |
| DRX | | | OFF | OFF | |
| Gap pattern ID | | | [N.A.] | *[*gp0*] | |
| ssb-Index | | | 2 | 2 | Number of SSB indexes used for beam failure detection |

| | | | | | |
|---|---|---|---|---|---|
| rlmInSyncOutOfSync Threshold | | | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | | TBD | TBD | Threshold used for $Q_{out\_LR\_SSB}$ |
| powerControlOffsetSS | | | NA | NA | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstance MaxCount | | | [n2] | [n2] | see TS 38.321 [7], section 5.17 |
| beamFailureDetection Timer | | | [pbfd4] | [pbfd4] | see TS 38.321 [7], section 5.17 |
| ZP CSI-RS configuation | | | TBD | TBD | |
| CSI-IM configuration | | | TBD | TBD | |
| Periodic CSI reporting | | | PUCCH | PUCCH | |
| CSI reporting periodicity | Config 1, 2 | slot | [5] | [5] | |
| | Config 3 | | [10] | [10] | |
| T1 | | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | s | 0.4 | 0.4 | |
| T3 | | s | [0.6] | [0.6] | |
| D1 | | s | [0.24] | [0.44] | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

**Table A.7.5.5.1.1-3: Cell specific test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode**

| Parameter | | Unit | Test 1 and Test 2 | | | | | Test 1 and Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SSB of set $q_0$ | | | | | SSB of set $q_1$ | | | | |
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| PDCCH_beta | | dB | 4 | | | | | 4 | | | | |
| PDCCH_DMRS_beta | | dB | 4 | | | | | 4 | | | | |
| PBCH_beta | | dB | | | | | | | | | | |
| PSS_beta | | dB | | | | | | | | | | |
| SSS_beta | | dB | | | | | | | | | | |
| PDSCH_beta | | dB | | | | | | | | | | |
| OCNG_beta | | dB | 0 | | | | | 0 | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/ 15K Hz | [-98] | | | | | [-98] | | | | |
| | Config 2 | | [-98] | | | | | [-98] | | | | |
| | Config 3 | | [-98] | | | | | [-98] | | | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | | | [TDL-C 300ns 100Hz] | | | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.1.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.7.5.5.1.1-4: Measurement gap configuration for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

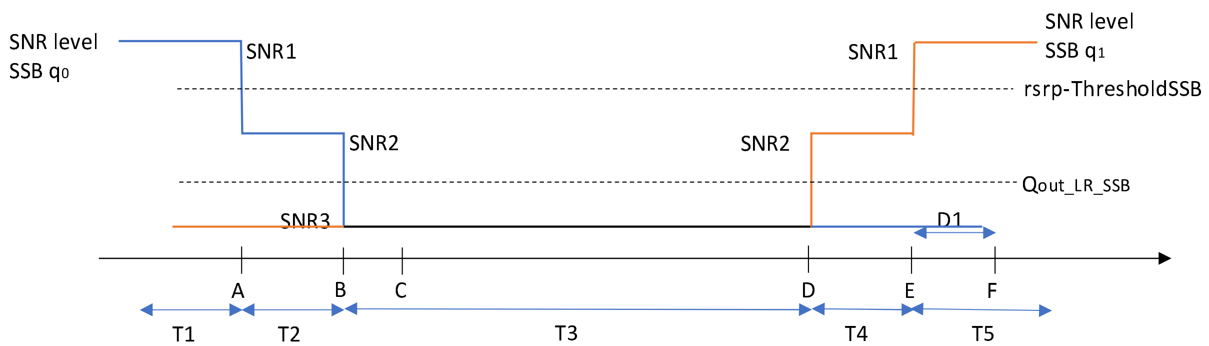


**Figure A.7.5.5.1.1-1: SNR variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode**

### A.7.5.5.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_1$.

No later than time point F occurring no later than D1 = [TBD] ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set $q_1$.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

### A.7.5.5.2 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with SSB-based BFD and LR in DRX mode

*Editor's note: It is open whether BFD can be based on SSB. This test case will be updated accordingly.*

#### A.7.5.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set $q_0$ configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candicate set $q_1$. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.7.5.5.2.1-1, A.7.5.5.2.1-2, A.7.5.5.2.1-3, A.7.5.5.2.1-4 and A.7.5.5.2.1-5 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.2.1-1 shows the variation of the downlink SNR of the SSB in set $q_0$ in the active cell to emulate SSB based beam failure. Figure A.7.5.5.2.1-1 additionally shows the variation of the downlink SNR of the SSB in set $q_1$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 2.

**Table A.7.5.5.2.1-1: Supported test configurations for FR2 PCell**

| Configuration | Description |
|---|---|
| 1 | TDD duplex mode, 120 kHz SSB SCS, 100MHz bandwidth |
| 2 | TDD duplex mode, 240 kHz SSB SCS, 100MHz bandwidth |
| Note: The UE is only required to pass in one of the supported test configurations in FR2 | |

**Table A.7.5.5.2.1-2: General test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in DRX mode**

| Parameter | | Unit | Value: Test 1 | Value: Test 2 | Comment |
|---|---|---|---|---|---|
| Active PCell | | | Cell 1 | Cell 1 | |
| RF Channel Number | | | 1 | 1 | |
| Duplex mode | Config 1 | | TDD | TDD | |
| | Config 2 | | TDD | TDD | |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] | |
| | Config 2 | | [TDDConf.3.1] | [TDDConf.3.1] | |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] | |
| | Config 2 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] | |
| SSB Configuration | Config 1 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| | Config 2 | | TBD (Note: periodicity is 20ms) | TBD (Note: periodicity is 20ms) | |
| SMTC Configuration | Config 1 | | TDD | TDD | |
| | Config 2 | | TDD | TDD | |
| PDSCH/ PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz | |
| | Config 2 | | 120 KHz | 120 KHz | |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] | |
| OCNG parameters | | | TBD | TBD | |
| CP length | | | Normal | Normal | |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] | |
| Beam failure detection trans mission parameters | DCI format | | 1-0 | 1-0 | |
| | Number of Control OFDM symbols | | 2 | 2 | |
| | Aggregation level | CCE | 8 | 8 | |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | DMRS precoder granularity | | REG bundle size | REG bundle size | |
| | REG bundle size | | 6 | 6 | |
| DRX | | | 640 | 640 | |
| Gap pattern ID | | | [N.A.] | *[*gp0*] | |
| ssb-Index | | | 2 | 2 | Number of SSB indexes used for beam failure detection |

| | | | | | |
|---|---|---|---|---|---|
| rlmInSyncOutOfSync Threshold | | | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | | TBD | TBD | Threshold used for $Q_{out\_LR\_SSB}$ |
| powerControlOffsetSS | | | NA | NA | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstance MaxCount | | | [n2] | [n2] | see TS 38.321 [7], section 5.17 |
| beamFailureDetection Timer | | | [pbfd4] | [pbfd4] | see TS 38.321 [7], section 5.17 |
| ZP CSI-RS configuation | | | TBD | TBD | |
| CSI-IM configuration | | | TBD | TBD | |
| Periodic CSI reporting | | | PUCCH | PUCCH | |
| CSI reporting periodicity | Config 1, 2 | slot | [5] | [5] | |
| | Config 3 | | [10] | [10] | |
| T1 | | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | s | 0.4 | 0.4 | |
| T3 | | s | [0.6] | [0.6] | |
| D1 | | s | [0.24] | [0.44] | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

**Table A.7.5.5.2.1-3: Cell specific test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in DRX mode**

| Parameter | | Unit | Test 1 and Test 2 | | | | | Test 1 and Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SSB of set $q_0$ | | | | | SSB of set $q_1$ | | | | |
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| PDCCH_beta | | dB | 4 | | | | | 4 | | | | |
| PDCCH_DMRS_beta | | dB | 4 | | | | | 4 | | | | |
| PBCH_beta | | dB | 0 | | | | | 0 | | | | |
| PSS_beta | | dB | | | | | | | | | | |
| SSS_beta | | dB | | | | | | | | | | |
| PDSCH_beta | | dB | | | | | | | | | | |
| OCNG_beta | | dB | | | | | | | | | | |
| SNR | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15K Hz | [-98] | | | | | [-98] | | | | |
| | Config 2 | | [-98] | | | | | [-98] | | | | |
| | Config 3 | | [-98] | | | | | [-98] | | | | |
| Propagation condition | | | [TDL-C 300ns 100Hz] | | | | | [TDL-C 300ns 100Hz] | | | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.2.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

**Table A.7.5.5.2.1-4: Measurement gap configuration for FR2 PCell for SSB-based beam failure detection and link recovery testing in DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

**Table A.7.5.5.2.1-5: DRX-Configuration for FR2 PCell for SSB-based beam failure detection and link recovery testing in DRX mode.**

| Field | Test 5 | Test 6 |
|---|---|---|
| | Value | Value |
| drx-onDurationTimer | [ms6] | [ms6] |
| drx-InactivityTimer | [ms1] | [ms1] |
| drx-RetransmissionTimerDL | [sl1] | [sl1] |
| drx-RetransmissionTimerUL | [sl1] | [sl1] |
| longDRX-CycleStartOffset | [ms640] | [ms40] |
| shortDRX | disable | disable |

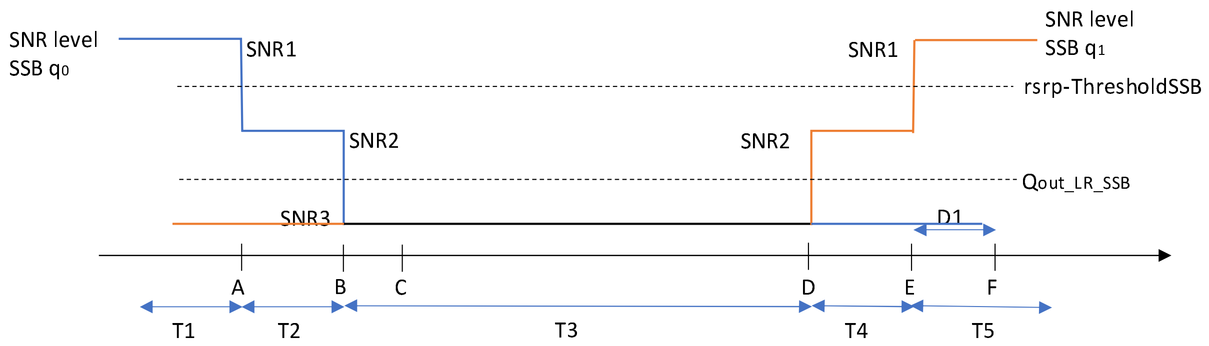


**Figure A.7.5.5.2.1-1: SNR variation for SSB-based beam failure detection and link recovery testing in non-DRX mode**

#### A.7.5.5.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_1$.

No later than time point F occurring no later than D1 = [TBD] ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set $q_1$.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

### A.7.5.5.3 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with CSI-RS-based BFD and LR in non-DRX mode

#### A.7.5.5.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set $q_0$ configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set $q_1$. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.7.5.5.3.1-1, A.7.5.5.3.1-2, A.7.5.5.3.1-3, A.7.5.5.3.1-4 and A.7.5.5.3.1-5 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.3.1-1 shows the variation of the downlink SNR of the CSI-RS in set $q_0$ in the active cell to emulate CSI-RS based beam failure. Figure A.7.5.5.3.1-1 additionally shows the variation of the downlink SNR of the CSI-RS in set $q_1$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 2.

**Table A.7.5.5.3.1-1: Supported test configurations for FR2 PCell**

| Configuration | Description |
|---|---|
| 1 | TDD duplex mode, 120 kHz SSB SCS, 100MHz bandwidth |

**Table A.7.5.5.3.1-2: General test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode**

| Parameter | | Unit | Value Test 1 | Value Test 2 | Comment |
|---|---|---|---|---|---|
| Active PCell | | | Cell 1 | Cell 1 | |
| RF Channel Number | | | 1 | 1 | |
| Duplex mode | Config 1 | | TDD | TDD | |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] | |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] | A.3.1.2 |
| SSB Configuration | Config 1 | | SSB.1 FR2 | SSB.1 FR2 | A.3.10 |
| SMTC Configuration | Config 1 | | SMTC.1 | SMTC.1 | A.3.11 |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120KHz | 120KHz | |
| csi-RS-Index assigned as beam failure RS | | | [0] | [0] | |
| OCNG parameters | | | TBD | TBD | A.3.2.1 |
| CP length | | | Normal | Normal | |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] | |
| Beam failure detection transmission parameters | DCI format | | 1-0 | 1-0 | |
| | Number of Control OFDM symbols | | 2 | 2 | |
| | Aggregation level | CCE | 8 | 8 | |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | DMRS precoder granularity | | REG bundle size | REG bundle size | |
| | REG bundle size | | 6 | 6 | |
| DRX | | | OFF | OFF | |
| Gap pattern ID | | | [N.A.] | *[*gp0*] | |

| | | | | | |
|---|---|---|---|---|---|
| csi-RS-Index | | | 2 | 2 | Number of SSB indexes used for beam failure detection |
| rlmInSyncOutOfSync Threshold | | | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | | TBD | TBD | Threshold used for $Q_{out\_LR\_SSB}$ |
| powerControlOffsetS S | | | NA | NA | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstance MaxCount | | | [n2] | [n2] | see TS 38.321 [7], section 5.17 |
| beamFailureDetection Timer | | | [pbfd4] | [pbfd4] | see TS 38.321 [7], section 5.17 |
| ZP CSI-RS configuation | | | TBD | TBD | |
| CSI-IM configuration | | | TBD | TBD | |
| Periodic CSI reporting | | | PUCCH | PUCCH | |
| CSI reporting periodicity | Config 1, 2 | slot | [5] | [5] | |
| | Config 3 | | [10] | [10] | |
| T1 | | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | | s | 0.4 | 0.4 | |
| T3 | | s | [TBD] | [TBD] | |
| D1 | | s | [0.24] | [0.44] | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | | |

**Table A.7.5.5.3.1-3: Cell specific test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode**

| Parameter | | Unit | Test 1 and Test 2 | | | | | Test 1 and Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CSI-RS of set $q_0$ | | | | | CSI-RS of set $q_1$ | | | | |
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PSS to SSS | | dB | 0 | | | | | 0 | | | | |
| EPRE ratio of PBCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | dB | | | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | dB | | | | | | | | | | |
| SNR_CSI-RS | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | | | [-98] | | | | |
| | Config 2 | | [-98] | | | | | [-98] | | | | |
| | Config 3 | | [-98] | | | | | [-98] | | | | |
| SS-RSRP Note 3 | | dBm/SCS | | | | | | | | | | |
| $\hat{E}_s/I_{ot}$ | | | | | | | | | | | | |
| $\hat{E}_s/N_{oc}$ | | | | | | | | | | | | |
| Io | config 1, 2 | dBm/9.36 MHz | | | | | | | | | | |
| | Config 3, 4 | dBm/38.1 MHz | | | | | | | | | | |
| Propagation condition | | | [TDLA30-75] | | | | | [TDLA30-75] | | | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

**Table A.7.5.5.3.1-4: Measurement gap configuration for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

**Table A.7.5.5.3.1-5: NZP-CSI-RS resource configuration for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation[Note 1] | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.4.5.1.7.1-1 | | |

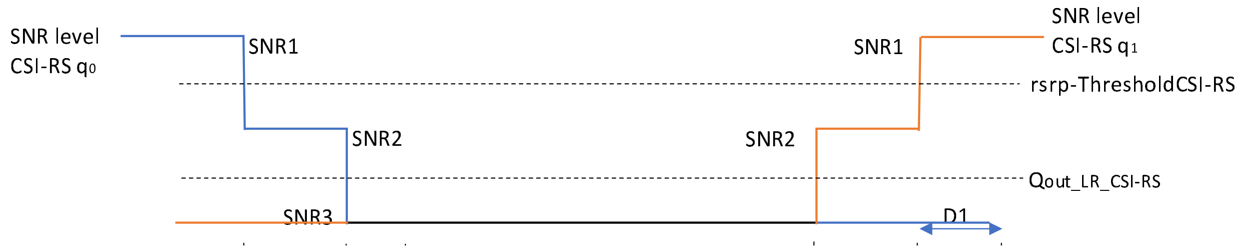


**Figure A.7.5.5.3.1-1: SNR variation SSB for CSI-RS based beam failure detection and link recovery testing in non-DRX mode**

### A.7.5.5.3.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_1$.

No later than time point F occurring no later than D1 = [TBD] ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set $q_1$.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

## A.7.5.5.4 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with CSI-RS-based BFD and LR in DRX mode

### A.7.5.5.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set $q_0$ configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set $q_1$. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.7.5.5.4.1-1, A.7.5.5.4.1-2, A.7.5.5.4.1-3, A.7.5.5.4.1-4, A.7.5.5.4.1-5 and A.7.5.5.4.1-6 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.4.1-1 shows the variation of the downlink SNR of the CSI-RS in set $q_0$ in the active cell to emulate CSI-RS based beam failure. Figure A.7.5.5.4.1-1 additionally shows the variation of the downlink SNR of the CSI-RS in set $q_1$ of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 2.

**Table A.7.5.5.4.1-1: Supported test configurations for FR2 PCell**

| Configuration | Description |
| --- | --- |
| 1 | TDD duplex mode, 120 kHz SSB SCS, 100MHz bandwidth |

**Table A.4.5.1.1.1-2: General test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

| Parameter | | Unit | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active PCell | | | Cell 1 | Cell 1 | |
| RF Channel Number | | | 1 | 1 | |
| Duplex mode | Config 1 | | TDD | TDD | |
| TDD Configuration | Config 1 | | [TDDConf.3.1] | [TDDConf.3.1] | |
| CORESET Reference Channel | Config 1 | | [CR. 3.1 TDD] | [CR. 3.1 TDD] | A.3.1.2 |
| SSB Configuration | Config 1 | | SSB.1 FR2 | SSB.1 FR2 | A.3.10 |
| SMTC Configuration | Config 1 | | SMTC.1 | SMTC.1 | A.3.11 |
| PDSCH/PDCCH subcarrier spacing | Config 1 | | 120 KHz | 120 KHz | |
| csi-RS-Index assigned as RLM RS | | | [0] | [0] | |
| OCNG parameters | | | TBD | TBD | A.3.2.1 |
| CP length | | | Normal | Normal | |
| Correlation Matrix and Antenna Configuration | | | [2x2 Low] | [2x2 Low] | |
| Beam failure detection transmission parameters | DCI format | | 1-0 | 1-0 | |
| | Number of Control OFDM symbols | | 2 | 2 | |
| | Aggregation level | CCE | 8 | 8 | |
| | Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy | dB | 0 | 0 | |
| | DMRS precoder granularity | | REG bundle size | REG bundle size | |
| | REG bundle size | | 6 | 6 | |
| DRX | | | 640 | 640 | |
| Gap pattern ID | | | [N.A.] | *[*gp0*] | |

| | | | | |
|---|---|---|---|---|
| csi-RS-Index | | 2 | 2 | Number of SSB indexes used for beam failure detection |
| rlmInSyncOutOfSync Threshold | | absent | absent | When the field is absent, the UE applies the value 0. (Table 8.1.1-1). |
| rsrp-ThresholdSSB | | TBD | TBD | Threshold used for $Q_{out\_LR\_SSB}$ |
| powerControlOffsetS S | | NA | NA | Used for deriving rsrp-ThresholdCSI-RS |
| beamFailureInstance MaxCount | | [n2] | [n2] | see TS 38.321 [7], section 5.17 |
| beamFailureDetection Timer | | [pbfd4] | [pbfd4] | see TS 38.321 [7], section 5.17 |
| ZP CSI-RS configuation | | TBD | TBD | |
| CSI-IM configuration | | TBD | TBD | |
| Periodic CSI reporting | | PUCCH | PUCCH | |
| CSI reporting periodicity: Config 1, 2 | slot | [5] | [5] | |
| CSI reporting periodicity: Config 3 | slot | [10] | [10] | |
| T1 | s | 1 | 1 | During this time the the UE shall be fully synchronized to cell 1 |
| T2 | s | 0.4 | 0.4 | |
| T3 | s | [TBD] | [TBD] | |
| D1 | s | [0.24] | [0.44] | |
| Note 1: UE-specific PDCCH is not transmitted after T1 starts. | | | | |

**Table A.7.5.5.4.1-3: Cell specific test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

| Parameter | | Unit | Test 1 and Test 2 | | | | | Test 1 and Test 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CSI-RS of set $q_0$ | | | | | CSI-RS of set $q_1$ | | | | |
| | | | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| EPRE ratio of PSS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PBCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | dB | | | 0 | | | | | 0 | | |
| EPRE ratio of PDCCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | dB | | | | | | | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | dB | | | | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS (Note 1) | | dB | | | | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | dB | | | | | | | | | | |
| SNR_CSI-RS | Config 1 | dB | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 2 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| | Config 3 | | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| $N_{oc}$ | Config 1 | dBm/15KHz | [-98] | | | | | [-98] | | | | |
| | Config 2 | | [-98] | | | | | [-98] | | | | |
| | Config 3 | | [-98] | | | | | [-98] | | | | |
| SS-RSRP (Note 3) | | dBm/SCS | | | | | | | | | | |
| $\hat{E}_s/I_{ot}$ | | | | | | | | | | | | |
| $\hat{E}_s/N_{oc}$ | | | | | | | | | | | | |
| Io | config 1, 2 | dBm/9.36 MHz | | | | | | | | | | |
| | Config 3, 4 | dBm/38.1 MHz | | | | | | | | | | |
| Propagation condition | | | [TDLA30-75] | | | | | [TDLA30-75] | | | | |

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

**Table A.7.5.5.4.1-4: Measurement gap configuration for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

| Field | Test 2 |
|---|---|
| | Value |
| gapOffset | [0] |

**Table A.7.5.5.4.1-5: NZP-CSI-RS resource configuration for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

| Field | ResourceId 0 | ResourceId 1 |
|---|---|---|
| | Value | Value |
| frequencyDomainAllocation Note 1 | row1 | row2 |
| startingRB | 0 | 0 |
| nrofRBs | Note 2 | Note 2 |
| Note 1: TS 38.211 [6] table 7.4.1.5.3-1<br>Note 2: nrofRBs is derived based on the Configuration in Table A.4.5.1.7.1-1 | | |

**Table A.7.5.5.4.1-6: DRX-Configuration for FR2 PCell for SSB-based beam failure detection and link recovery testing in DRX mode.**

| Field | Test 5 | Test 6 |
|---|---|---|
| | Value | Value |
| drx-onDurationTimer | [ms6] | [ms6] |
| drx-InactivityTimer | [ms1] | [ms1] |
| drx-RetransmissionTimerDL | [sl1] | [sl1] |
| drx-RetransmissionTimerUL | [sl1] | [sl1] |
| longDRX-CycleStartOffset | [ms640] | [ms40] |
| shortDRX | disable | disable |

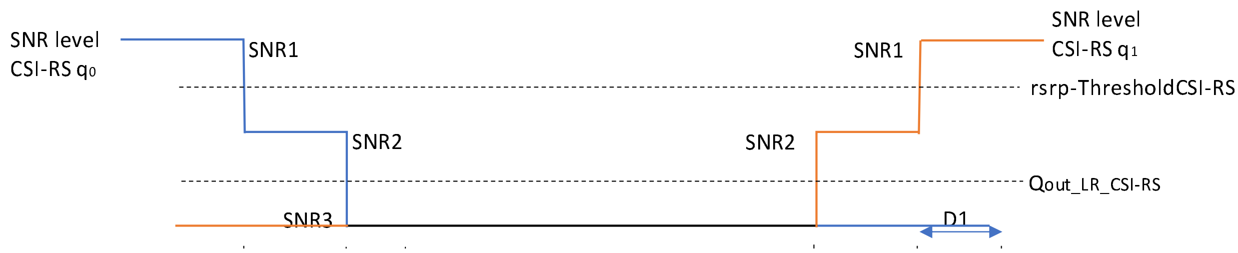


**Figure A.7.5.5.4.1-1: SNR variation SSB for CSI-RS-based beam failure detection and link recovery testing in DRX mode**

## A.7.5.5.4.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set $q_1$.

No later than time point F occurring no later than D1 = [TBD] ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set $q_1$.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

## A.7.5.6 Active BWP switch delay

### A.7.5.6.1 DCI-based and Timer-based Active BWP Switch

#### A.7.5.6.1.1 NR FR2- NR FR2 DL active BWP switch of PCell with non-DRX in SA

##### A.7.5.6.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in section 8.6, and interruption requirement on other active serving cell defined in section 8.2.2.2.5.

The supported test configurations are shown in Table A.7.5.6.1.1.1-1 below. The test scenario comprises of one NR PCell (Cell 1) and one NR SCell (Cell 2) as given in Table A.7.5.6.1.1.1-2. NR Cell-specific parameters are specified in Table A.7.5.6.1.1.1-3 below. OTA related test parameters are shown in table A.7.5.6.1.1.1-4 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 1 and the time duration of T2.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 2) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (SCell) on radio channel 2 (SCC).
- UE is configured with 2 different UE-specific bandwidth parts for PCell, BWP-1 and BWP-2, in Cell 1 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.
>
> The UE shall be able to receive PDSCH no later than at PCell's slot ($i+T_{BWPswitchDelay}$) as defined in section 8.6 and starts to report valid ACK/NACK for the PCell no later than at slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PCell's BWP-2 no later than slot ($i+T_{BWPswitchDelay}$).
>
> The starting time of SCell (Cell 2) interruption due to BWP switch on PCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PCell(Cell 1).

During T3,

> The time period T3 starts from the slot #*j* immediately after the slot wherein *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.
>
> The UE shall be able to receive PDSCH no later than PCell's slot ($j+T_{BWPswitchDelay}$) as defined in section 8.6 and starts to report valid ACK/NACK for the SCell at latest at slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on SCell's BWP-1 no later than slot ($j+T_{BWPswitchDelay}$).
>
> The starting time of SCell (Cell 2) interruption due to BWP switch of PCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to SCell is carried out in the correct time span by monitoring ACK/NACK sent in SCell during BWP switch of PCell, respectively.

**Table A.7.5.6.1.1.1-1: DL BWP switch supported test configurations**

| Config | Description |
|---|---|
| 1 | NR 120 kHz SSB SCS, 100MHz bandwidth, TDD -TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations | |

**Table A.7.5.6.1.1.1-2: General test parameters for DL BWP switch in SA**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| NR RF Channel Number | | 2 | Two NR radio channel is used for this test |
| Active PCell | | Cell 1 | PCell on RF channel number 1. |
| Active SCell | | Cell 2 | SCell on RF channel number 2. |
| CP length | | Normal | |
| DRX | | OFF | For both PCell and SCell |
| *bwp-InactivityTimer* | ms | [200] | |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on SCC. |
| Cell2 timing offset to cell1 | μs | 3 | Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1. |
| T1 | s | [0.2] | |
| T2 | s | [0.2] | |
| T3 | s | [0.2] | |

**Table A7.5.6.1.1.1-3: NR Cell specific test parameters for DL BWP switch in SA**

| Parameter | Unit | Cell 1 | Cell2 |
|---|---|---|---|
| Frequency Range | | FR2 | FR2 |
| Duplex mode | | TDD | |
| TDD configuration | | TDDConf.3.1 | |
| $BW_{channel}$ | | 100 MHz: $N_{RB,c}$ = 66 | |
| Active BWP ID | | 1, 2 | 3 |
| Initial BWP Configuration | | DLBWP.0.2 Note2 | |
| Active BWP-1 Configuration | | DLBWP.1.1 Note2 | - |
| Active BWP-2 Configuration | | DLBWP.1.3 Note2 | - |
| PDSCH Reference measurement channel | | SR.3.1 TDD | |
| RMSI CORESET parameters | | CR.3.1 TDD | |
| Dedicated CORESET parameters | | CCR.3.1 TDD | |
| OCNG Patterns | | OP.1 | |
| SSB Configuration | | SSB.1 FR2 | |
| SMTC Configuration | | SMTC.1 | |
| Correlation Matrix and Antenna Configuration | | 1x2 Low | |
| EPRE ratio of PSS to SSS | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | |
| EPRE ratio of PDSCH to PDSCH | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | |
| $\hat{E}_s/N_{oc}$ | dB | [17] | [17] |
| Propagation Condition | | AWGN | AWGN |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in TS 38.213 [3] section 12. | | | |

**Table A.7.5.6.1.1-4: OTA related test parameters for BWP switching test case**

| Parameter | | Unit | Cell 1 | Cell 2 |
|---|---|---|---|---|
| Angle of arrival configuration | | | According to table A.X.X | According to table A.X.X |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/15kHz | TBD | TBD |
| | NR_TDD_FR2_B | | | |
| | NR_TDD_FR2_F | | | |
| | NR_TDD_FR2_G | | | |
| | NR_TDD_FR2_T | | | |
| | NR_TDD_FR2_Y | | | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/SCS | TBD | TBD |
| | NR_TDD_FR2_B | | | |
| | NR_TDD_FR2_F | | | |
| | NR_TDD_FR2_G | | | |
| | NR_TDD_FR2_T | | | |
| | NR_TDD_FR2_Y | | | |
| SS-RSRP Note2 | NR_TDD_FR2_A | dBm/120KHz Note3 | TBD | TBD |
| | NR_TDD_FR2_B | | | |
| | NR_TDD_FR2_F | | | |
| | NR_TDD_FR2_G | | | |
| | NR_TDD_FR2_T | | | |
| | NR_TDD_FR2_Y | | | |

| | | | | |
|---|---|---|---|---|
| $\hat{E}_s/I_{ot}$ | | dB | TBD | TBD |
| Io^Note2 | NR_TDD_FR2_A<br>NR_TDD_FR2_B<br>NR_TDD_FR2_F<br>NR_TDD_FR2_G<br>NR_TDD_FR2_T<br>NR_TDD_FR2_Y | dBm/95.04 MHz Note4 | TBD | TBD |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone | | | | |

##### A.7.5.6.1.1.2 Test Requirements

During T1, the UE shall start to send the ACK for SCell in a slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for SCell in a slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in Table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1 and T3, the start time of SCell interruption during PCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of SCell shall not be longer than the interruption duration specified for active BWP switch in Section 8.2.2.2.5.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in a slot ($i+ T_{BWPswitchDelay}+k1$), ($j+ T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

#### A.7.5.6.1.2 NR FR1- NR FR2 DL active BWP switch of PCell with non-DRX in SA

##### A.7.5.6.1.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in section 8.6, and interruption requirement on other active serving cell defined in section 8.2.2.2.5.

The supported test configurations are shown in Table A.7.5.6.1.2.1-1 below. The test scenario comprises of one NR PCell (Cell 1) and one NR SCell (Cell 2). The general parameters are given in Table A.7.5.6.1.2.1-2. NR Cell-specific parameters are specified in Table A.7.5.6.1.2.1-3 below. OTA related test parameters are shown in table A.7.5.6.1.2.1-4 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 1 and the time duration of T2.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 2) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (SCell) on radio channel 2 (SCC).
- UE is configured with 2 different UE-specific bandwidth parts for PCell, BWP-1 and BWP-2, in Cell 1 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH no later than at PCell's slot ($i+T_{BWPswitchDelay}$) as defined in section 8.6 and starts to report valid ACK/NACK for the PCell no later than at slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PCell's BWP-2 no later than slot ($i+T_{BWPswitchDelay}$).

The starting time of SCell (Cell 2) interruption due to BWP switch on PCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PCell(Cell 1).

During T3,

The time period T3 starts from the slot #*j* immediately after the slot wherein *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH no later than PCell's slot ($j+T_{BWPswitchDelay}$) as defined in section 8.6 and starts to report valid ACK/NACK for the SCell at latest at slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on SCell's BWP-1 no later than slot ($j+T_{BWPswitchDelay}$).

The starting time of SCell (Cell 2) interruption due to BWP switch of PCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to SCell is carried out in the correct time span by monitoring ACK/NACK sent in SCell during BWP switch of PCell, respectively.

**Table A.7.5.6.1.1.1-1: DL BWP switch supported test configurations**

| Config | Description |
|---|---|
| 1 | PCell: NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode<br>SCell: NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | PCell: NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode<br>SCell: NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 3 | PCell: NR 30 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode<br>SCell: NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations | |

**Table A.7.5.6.1.1.1-2: General test parameters for DL BWP switch in SA**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| NR RF Channel Number | | 2 | Two NR radio channel is used for this test |
| Active PCell | | Cell 1 | PCell on RF channel number 1. |
| Active SCell | | Cell 2 | SCell on RF channel number 2. |
| CP length | | Normal | |
| DRX | | OFF | For both PCell and SCell |
| *bwp-InactivityTimer* | ms | [200] | |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| Cell-individual offset for cells on RF channel number 2 | dB | 0 | Individual offset for cells on SCC. |
| Cell2 timing offset to cell1 | μs | 3 | Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1. |
| T1 | s | [0.2] | |
| T2 | s | [0.2] | |
| T3 | s | [0.2] | |

**Table A6.5.6.1.1.1-3: NR Cell specific test parameters for DL BWP switch in SA**

| Parameter | | Unit | Cell 1 | Cell2 |
|---|---|---|---|---|
| Frequency Range | | | FR1 | FR2 |
| Duplex mode | Config 1 | | FDD | TDD |
| | Config 2,3 | | TDD | |
| TDD configuration | Config 1 | | Not Applicable | TDDConf.3.1 |
| | Config 2 | | TDDConf.1.1 | |
| | Config 3 | | TDDConf.2.1 | |
| $BW_{channel}$ | Config 1,2 | MHz | 10 MHz: $N_{RB,c}$ = 52 | 100 MHz: $N_{RB,c}$ = 66 |
| | Config 3 | | 40 MHz: $N_{RB,c}$ = 106 | |
| Active BWP ID | | | 1, 2 | 3 |
| Initial BWP Configuration | | | DLBWP.0.2[Note4] | |
| Active BWP-1 Configuration | | | DLBWP.1.1 [Note4] | - |
| Active BWP-2 Configuration | | | DLBWP.1.3 [Note4] | - |
| PDSCH Reference measurement channel | Config 1 | | SR.1.1 FDD | SR.3.1 TDD |
| | Config 2 | | SR.1.1 TDD | |
| | Config 3 | | SR.2.1 TDD | |
| RMSI CORESET parameters | Config 1 | | CR.1.1 FDD | CR.3.1 TDD |
| | Config 2 | | CR.1.1 TDD | |
| | Config 3 | | CR.2.1 TDD | |
| Dedicated CORESET parameters | Config 1 | | CCR.1.1 FDD | CCR.3.1 TDD |
| | Config 2 | | CCR.1.1 TDD | |
| | Config 3 | | CCR.2.1 TDD | |
| OCNG Patterns | | | OP.1 | |
| SSB Configuration | Config 1,2 | | SSB.1 FR1 | SSB.1 FR2 |
| | Config 3 | | SSB.2 FR1 | |
| SMTC Configuration | | | SMTC.1 | |
| Correlation Matrix and Antenna Configuration | | | 1x2 Low | |
| EPRE ratio of PSS to SSS | | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | |
| $\hat{E}_s/N_{oc}$ | | dB | [17] | [17] |
| $N_{oc}$ Note2 | Config 1,2 | dBm/SCS | [-104] | Defined in Table A.7.5.6.1.1-4 |
| | Config 3 | | [-101] | |
| $N_{oc}$ Note2 | | dBm/15KHz | [-104] | Defined in Table A.7.5.6.1.1-4 |
| $\hat{E}_s/I_{ot}$ | | dB | [17] | Defined in Table A.7.5.6.1.1-4 |
| SS-RSRP Note3 | Config 1,2 | dBm/SCS | [-87] | Defined in Table A.7.5.6.1.1-4 |
| | Config 3 | | [-84] | |
| SCH_RP Note 3 | | dBm/15 kHz | [-87] | Defined in Table A.7.5.6.1.1-4 |
| Propagation Condition | | | AWGN | AWGN |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.

Note 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in TS 38.213 [3] section 12.

**Table A.7.5.6.1.1-4: OTA related test parameters for BWP switching test case**

| Parameter | | Unit | Cell 2 |
|---|---|---|---|
| Angle of arrival configuration | | | According to table A.X.X |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/15kHz | TBD |
| | NR_TDD_FR2_B | | |
| | NR_TDD_FR2_F | | |
| | NR_TDD_FR2_G | | |
| | NR_TDD_FR2_T | | |
| | NR_TDD_FR2_Y | | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/SCS | TBD |
| | NR_TDD_FR2_B | | |
| | NR_TDD_FR2_F | | |
| | NR_TDD_FR2_G | | |
| | NR_TDD_FR2_T | | |
| | NR_TDD_FR2_Y | | |
| SS-RSRP Note2 | NR_TDD_FR2_A | dBm/SCS Note3 | TBD |
| | NR_TDD_FR2_B | | |
| | NR_TDD_FR2_F | | |
| | NR_TDD_FR2_G | | |
| | NR_TDD_FR2_T | | |
| | NR_TDD_FR2_Y | | |
| $\hat{E}_s/I_{ot}$ | | dB | TBD |
| Io Note2 | NR_TDD_FR2_A | dBm/95.04 MHz Note4 | TBD |
| | NR_TDD_FR2_B | | |
| | NR_TDD_FR2_F | | |
| | NR_TDD_FR2_G | | |
| | NR_TDD_FR2_T | | |
| | NR_TDD_FR2_Y | | |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone | | | |

A.7.5.6.1.2.2 Test Requirements

During T1, the UE shall start to send the ACK for SCell in a slot ($i$+$T_{BWPswitchDelay}$+$k1$).

During T3, the UE shall start to send the ACK for SCell in a slot ($j$+$T_{BWPswitchDelay}$+$k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in Table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1 and T3, the start time of SCell interruption during PCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of SCell shall not be longer than the interruption duration specified for active BWP switch in Section 8.2.2.2.5.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in a slot ($i+ T_{BWPswitchDelay}+k1$), ($j+ T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

## A.7.5.6.2 RRC-based Active BWP Switch

### A.7.5.6.2.1 NR FR2- NR FR2 DL active BWP switch of PCell with non-DRX in SA

#### A.7.5.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in section 8.6. Supported test configurations are shown in Table A.7.5.6.2.1.1-1.

The test scenario comprises of one NR PCell (Cell 1) as given in Table A.7.5.6.2.1.1-2. Cell-specific parameters of NR PCell are specified in Table A.7.5.6.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PCell.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with bandwidth part configuration BWP-2, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted $i$. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH at PCell's slot ($i+X$) as defined in section 8.6 and starts to report valid ACK/NACK for the PCell no later than at slot ($i+X+k1$). The UE shall be continuously scheduled on PCell's BWP-2 starting from slot ($i+X$).

The test equipment verifies the DL BWP switch time in PCell by counting the slots from the time when the RRC Reconfiguration message including BWP switch command is received till an ACK is received.

**Table A.7.5.6.2.1.1-1: DL BWP switch supported test configurations**

| Config | Description |
|---|---|
| 1 | NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note 1: The UE is only required to be tested in one of the supported test configurations | |

**Table A.7.5.6.2.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| NR RF Channel Number | | 1 | One NR radio channel is used for this test |
| Active PCell | | Cell 1 | PCell on RF channel number 1. |
| CP length | | Normal | |
| DRX | | OFF | |
| Cell-individual offset for cells on RF channel number 1 | dB | 0 | Individual offset for cells on PCC. |
| T1 | s | [0.2] | |

**Table A.7.5.6.2.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC**

| Parameter | Unit | Cell 1 |
|---|---|---|
| Frequency Range | | FR2 |
| Duplex mode | | TDD |
| TDD configuration | | TDDConf.3.1 |
| $BW_{channel}$ | | 100 MHz: $N_{RB,c}$ = 66 |
| Active BWP ID | | 1, 2 |
| Initial BWP Configuration | | DLBWP.0.2 |
| Active BWP-1 Configuration | | DLBWP.1.3 |
| Active BWP-2 Configuration | | DLBWP.1.1 |
| PDSCH Reference measurement channel | | SR.3.1 TDD |
| RMSI CORESET parameters | | CR.3.1 TDD |
| Dedicated CORESET parameters | | CCR.3.1 TDD |
| OCNG Patterns | | OP.1 |
| SSB Configuration | | SSB.1 FR2 |
| SMTC Configuration | | SMTC.1 |
| TCI State | | TBD |
| TRS Configuration | | TBD |
| Antenna Configuration | | 1x2 |
| Propagation Condition | | AWGN |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS | | |
| EPRE ratio of PBCH to PBCH DMRS | | |
| EPRE ratio of PDCCH DMRS to SSS | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | |
| EPRE ratio of PDSCH DMRS to SSS | | |
| EPRE ratio of PDSCH to PDSCH | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in TS 38.213 [3] section 12. | | |

#### A.7.5.6.2.2.2 Test Requirements

During T1, the UE shall start to send the ACK for PCell in a slot ($i+X+k1$).

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, if there are no uplink resources for reporting the ACK in a slot ($i+X+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

*Editor's note: FFS value of X, k1 for type 1 and type 2 UE.*

# A.7.6 Measurement procedure

## A.7.6.1 Intra-frequency Measurements

### A.7.6.1.1 SA event triggered reporting test without gap under non-DRX

#### A.7.6.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.1.1-1.

**Table A.7.6.1.1.1-1: supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in Table A.7.6.1.1.1-1 and A.7.6.1.1.1-2 below.

In the measurement control information a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

**Table A.7.6.1.1.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX**

| Parameter | Unit | Config | Value | Comment |
|---|---|---|---|---|
| Active cell | | 1, 2 | PCell (Cell 1) | |
| Neighbour cell | | 1, 2 | Cell 2 | Cell to be identified. |
| RF Channel Number | | 1, 2 | 1: Cell 1 and Cell 2 | One TDD carrier frequency is used for the NR cells. |
| Gap type | | 1, 2 | n.a. | |
| Measurement gap repitition periodicity | ms | 1, 2 | n.a. | |
| Measurement gap length | ms | 1, 2 | n.a. | |
| Measurement gap offset | ms | 1, 2 | n.a. | |
| SMTC configuration | | 1, 2 | SMTC.1 | |
| A3-Offset | dB | 1, 2 | -6 | |
| CP length | | 1, 2 | Normal | |
| Hysteresis | dB | 1, 2 | 0 | |
| Time To Trigger | s | 1, 2 | 0 | |
| Filter coefficient | | 1, 2 | 0 | L3 filtering is not used |
| DRX | | 1, 2 | OFF | |
| Time offset between Cell 1 and Cell 2 | | 1, 2 | 3 μs | Synchronous EN-DC |
| Time offset between Cell 2 and Cell 3 | | 1, 2 | 3 μs | Synchronous cells |
| T1 | s | 1, 2 | 5 | |
| T2 | s | 1, 2 | 5 | |

**Table A.7.6.1.1.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX**

| Parameter | Unit | Config | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |

| | | | | |
|---|---|---|---|---|
| TDD configuration | | 1, 2 | TDDConf.3.1 | TDDConf.3.1 |
| Intial BWP configuration | | 1, 2 | DLBWP.0<br>ULBWP.0 | DLBWP.0<br>ULBWP.0 |
| Active DL BWP configuration | | 1, 2 | DLBWP.1 | DLBWP.1 |
| Active UL BWP configuration | | 1, 2 | ULBWP.1 | ULBWP.1 |
| RLM-RS | | 1, 2 | SSB | SSB |
| PDSCH RMC configuration | | 1, 2 | SR.3.1 TDD | N/A |
| RMSI CORESET RMC configuration | | 1, 2 | CR.3.1 TDD | CR.3.1 TDD |
| Dedicated CORESET RMC configuration | | 1, 2 | CCR.3.1 TDD | CCR.3.1 TDD |
| OCNG Patterns | | 1, 2 | OP.1 | OP.1 |
| SSB | | 1 | SSB.1 FR2 | SSB.1 FR2 |
| | | 2 | SSB.2 FR2 | SSB.2 FR2 |
| Propagation Condition | | 1, 2 | AWGN | |

**Table A.7.6.1.1.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX**

| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| AoA setup | | 1, 2 | A.3.8.x | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1, 2 | TBD | TBD | TBD | TBD |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1, 2 | TBD | | | |
| $N_{oc}$ Note 2 | dBm/SCS | 1 | TBD | | | |
| | | 2 | TBD | | | |
| SS-RSRP | dBm/SCS | 1 | TBD | TBD | TBD | TBD |
| | | 2 | TBD | TBD | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | 1, 2 | TBD | TBD | TBD | TBD |
| $Io$ | dBm/95.04MHz | 1, 2 | TBD | | TBD | |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | |

### A.7.6.1.1.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 2.4s for a UE supporting power class 1,
- 1.44s for a UE supporting power class 2 or 3,
- [1.44s] for a UE supporting power class 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.7.6.1.2 SA event triggered reporting test without gap under DRX

#### A.7.6.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.2.1-1.

**Table A.7.6.1.2.1-1: supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in Table A.7.6.1.2.1-2 ~ 6.

In the measurement control information a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

**Table A.7.6.1.2.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX**

| Parameter | Unit | Config | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active cell | | 1, 2 | PCell (Cell 1) | | |
| Neighbour cell | | 1, 2 | Cell 2 | | Cell to be identified. |
| RF Channel Number | | 1, 2 | 1: Cell 1 and Cell 2 | | One TDD carrier frequency is used for the NR cells. |
| Gap type | | 1, 2 | n.a. | | |
| Measurement gap repitition periodicity | ms | 1, 2 | n.a. | | |
| Measurement gap length | ms | 1, 2 | n.a. | | |
| Measurement gap offset | ms | 1, 2 | n.a. | | |
| SMTC configuration | | 1, 2 | SMTC.1 | | |
| A3-Offset | dB | 1, 2 | -6 | | |
| CP length | | 1, 2 | Normal | | |
| Hysteresis | dB | 1, 2 | 0 | | |
| Time To Trigger | s | 1, 2 | 0 | | |
| Filter coefficient | | 1, 2 | 0 | | L3 filtering is not used |
| DRX | | 1, 2 | ON | | DRX related parameters are defined in Table A.7.6.1.2.1-5 |
| Time offset between Cell 1 and Cell 2 | | 1, 2 | 3 µs | | Synchronous EN-DC |
| Time offset between Cell 2 and Cell 3 | | 1, 2 | 3 µs | | Synchronous cells |
| T1 | s | 1, 2 | 5 | | |
| T2 | s | 1, 2 | 10 | TBD | |

**Table A.7.6.1.2.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX**

| Parameter | Unit | Config | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |

| | | | | |
|---|---|---|---|---|
| TDD configuration | | 1, 2 | TDDConf.3.1 | TDDConf.3.1 |
| Intial BWP configuration | | 1, 2 | DLBWP.0<br>ULBWP.0 | DLBWP.0<br>ULBWP.0 |
| Active DL BWP configuration | | 1, 2 | DLBWP.1 | DLBWP.1 |
| Active UL BWP configuration | | 1, 2 | ULBWP.1 | ULBWP.1 |
| RLM-RS | | 1, 2 | SSB | SSB |
| PDSCH RMC configuration | | 1, 2 | SR.3.1 TDD | N/A |
| RMSI CORESET RMC configuration | | 1, 2 | CR.3.1 TDD | CR.3.1 TDD |
| Dedicated CORESET RMC configuration | | 1, 2 | CCR.3.1 TDD | CCR.3.1 TDD |
| OCNG Patterns | | 1, 2 | OP.1 | OP.1 |
| SSB | | 1 | SSB.1 FR2 | SSB.1 FR2 |
| | | 2 | SSB.2 FR2 | SSB.2 FR2 |
| Propagation Condition | | 1, 2 | AWGN | |

**Table A.7.6.1.2.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX**

| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| AoA setup | | 1, 2 | A.3.8.x | | | |
| $\hat{E}_s / I_{ot}$ | dB | 1, 2 | TBD | TBD | TBD | TBD |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1, 2 | TBD | | | |
| $N_{oc}$ Note 2 | dBm/SCS | 1 | TBD | | | |
| | | 2 | TBD | | | |
| SS-RSRP | dBm/SCS | 1 | TBD | TBD | TBD | TBD |
| | | 2 | TBD | TBD | TBD | TBD |
| $\hat{E}_s / N_{oc}$ | dB | 1, 2 | TBD | TBD | TBD | TBD |
| $Io$ | dBm/95.04MHz | 1, 2 | TBD | | TBD | |
| | Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | |

**Table A.7.6.1.2.1-5: DRX-Configuration for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX**

| Field | Value | Value | Comment |
|---|---|---|---|
| | Test1 | Test2 | |
| onDurationTimer | psf1 | psf1 | As specified in clause 6.3.2 in TS 38.331 [2] |
| drx-InactivityTimer | psf1 | psf1 | |
| drx-RetransmissionTimer | psf1 | psf1 | |
| longDRX-CycleStartOffset | Sf40 | sf640 | |
| shortDRX | disable | disable | |

**Table A.7.6.1.2.1-6: *TimeAlignmentTimer* -Configuration for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX**

| Field | Value | Value | Comment |
|---|---|---|---|
| | Test1 | Test2 | |
| TimeAlignmentTimer | sf500 | sf500 | As specified in clause 6.3.2 in TS 38.331 [2] |

#### A.7.6.1.2.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 7.2s for a UE supporting power class 1,
- 4.32s for a UE supporting power class 2 or 3,
- [4.32s] for a UE supporting power class 4

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 51.2s for a UE supporting power class 1,
- 30.72s for a UE supporting power class 2 or 3,
- [30.72s] for a UE supporting power class 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.7.6.1.3 SA event triggered reporting test with per-UE gaps under non-DRX

#### A.7.6.1.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.3.1-1.

**Table A.7.6.1.3.1-1: supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in Table A.7.6.1.3.1-2 ~ 4 below.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

**Table A.7.6.1.3.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps without DRX**

| Parameter | Unit | Config | Value | Comment |
|---|---|---|---|---|
| Active cell | | 1, 2 | PCell (Cell 1) | |
| Neighbour cell | | 1, 2 | Cell 2 | Cell to be identified. |
| RF Channel Number | | 1, 2 | 1: Cell 1 and Cell 2 | One TDD carrier frequency is used for the NR cells. |
| Gap type | | 1, 2 | Per-UE gaps | |
| Measurement gap repitition periodicity | ms | 1, 2 | 40 | |
| Measurement gap length | ms | 1, 2 | 6 | |
| Measurement gap offset | ms | 1, 2 | 39 | |
| SMTC configuration | | 1, 2 | SMTC.1 | |
| A3-Offset | dB | 1, 2 | -6 | |
| CP length | | 1, 2 | Normal | |
| Hysteresis | dB | 1, 2 | 0 | |
| Time To Trigger | s | 1, 2 | 0 | |
| Filter coefficient | | 1, 2 | 0 | L3 filtering is not used |
| DRX | | 1, 2 | OFF | |
| Time offset between Cell 1 and Cell 2 | | 1, 2 | 3 μs | Synchronous EN-DC |
| Time offset between Cell 2 and Cell 3 | | 1, 2 | 3 μs | Synchronous cells |
| T1 | s | 1, 2 | 5 | |
| T2 | s | 1, 2 | 5 | |

**Table A.7.6.1.3.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps without DRX**

| Parameter | Unit | Config | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1, 2 | TDDConf.3.1 | | TDDConf.3.1 | |
| Intial BWP configuration | | 1, 2 | DLBWP.0<br>ULBWP.0 | | DLBWP.0<br>ULBWP.0 | |
| Active DL BWP configuration | | 1, 2 | DLBWP.1 | | DLBWP.1 | |
| Active UL BWP configuration | | 1, 2 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1, 2 | CSI-RS | | CSI-RS | |
| PDSCH RMC configuration | | 1, 2 | SR.3.1 TDD | | N/A | |
| RMSI CORESET RMC configuration | | 1, 2 | CR.3.1 TDD | | CR.3.1 TDD | |
| Dedicated CORESET RMC configuration | | 1, 2 | CCR.3.1 TDD | | CCR.3.1 TDD | |
| OCNG Patterns | | 1, 2 | OP.1 | | OP.1 | |
| SSB | | 1 | SSB.1 FR2 | | SSB.1 FR2 | |
| | | 2 | SSB.2 FR2 | | SSB.2 FR2 | |
| Propagation Condition | | 1, 2 | AWGN | | | |

**Table A.7.6.1.3.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps without DRX**

| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| AoA setup | | 1, 2 | A.3.8.x | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1, 2 | TBD | TBD | TBD | TBD |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1, 2 | TBD | | | |
| $N_{oc}$ Note 2 | dBm/SCS | 1 | TBD | | | |
| | | 2 | TBD | | | |
| SS-RSRP | dBm/SCS | 1 | TBD | TBD | TBD | TBD |
| | | 2 | TBD | TBD | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | 1, 2 | TBD | TBD | TBD | TBD |
| $Io$ | dBm/95.04MHz | 1, 2 | TBD | | TBD | |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | |

### A.7.6.1.3.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 3.2s for a UE supporting power class 1,
- 1.92s for a UE supporting power class 2 or 3,
- [1.92s] for a UE supporting power class 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI$_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

## A.7.6.1.4 SA event triggered reporting test with per-UE gaps under DRX

### A.7.6.1.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.4.1-1.

**Table A.7.6.1.4.1-1: supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. | |

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in Table A.7.6.1.4.1-1 and A.7.6.1.4.1-2 below.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

**Table A.7.6.1.4.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps with DRX**

| Parameter | Unit | Config | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| Active cell | | 1, 2 | PCell (Cell 1) | | |
| Neighbour cell | | 1, 2 | Cell 2 | | Cell to be identified. |
| RF Channel Number | | 1, 2 | 1: Cell 1 and Cell 2 | | One TDD carrier frequency is used for the NR cells. |
| Gap type | | 1, 2 | Per-UE gaps | | |
| Measurement gap repitition periodicity | ms | 1, 2 | 40 | | |
| Measurement gap length | ms | 1, 2 | 6 | | |
| Measurement gap offset | ms | 1, 2 | 39 | | |
| SMTC configuration | | 1, 2 | SMTC.1 | | |
| A3-Offset | dB | 1, 2 | -6 | | |
| CP length | | 1, 2 | Normal | | |
| Hysteresis | dB | 1, 2 | 0 | | |
| Time To Trigger | s | 1, 2 | 0 | | |
| Filter coefficient | | 1, 2 | 0 | | L3 filtering is not used |
| DRX | | 1, 2 | ON | | DRX related parameters are defined in Table A.7.6.1.2.1-5 |
| Time offset between Cell 1 and Cell 2 | | 1, 2 | 3 µs | | Synchronous EN-DC |
| Time offset between Cell 2 and Cell 3 | | 1, 2 | 3 µs | | Synchronous cells |
| T1 | s | 1, 2 | 5 | | |
| T2 | s | 1, 2 | 10 | TBD | |

**Table A.7.6.1.4.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps with DRX**

| Parameter | Unit | Config | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |
| TDD configuration | | 1, 2 | TDDConf.3.1 | | TDDConf.3.1 | |
| Intial BWP configuration | | 1, 2 | DLBWP.0<br>ULBWP.0 | | DLBWP.0<br>ULBWP.0 | |
| Active DL BWP configuration | | 1, 2 | DLBWP.1 | | DLBWP.1 | |
| Active UL BWP configuration | | 1, 2 | ULBWP.1 | | ULBWP.1 | |
| RLM-RS | | 1, 2 | SSB | | SSB | |
| PDSCH RMC configuration | | 1, 2 | SR.3.1 TDD | | N/A | |
| RMSI CORESET RMC configuration | | 1, 2 | CR.3.1 TDD | | CR.3.1 TDD | |
| Dedicated CORESET RMC configuration | | 1, 2 | CCR.3.1 TDD | | CCR.3.1 TDD | |
| OCNG Patterns | | 1, 2 | OP.1 | | OP.1 | |
| SSB | | 1 | SSB.1 FR2 | | SSB.1 FR2 | |
| | | 2 | SSB.2 FR2 | | SSB.2 FR2 | |
| Propagation Condition | | 1, 2 | AWGN | | | |

**Table A.7.6.1.4.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps with DRX**

| Parameter | Unit | Config | Cell 2 | | Cell 3 | |
|---|---|---|---|---|---|---|
| | | | T1 | T2 | T1 | T2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| AoA setup | | 1, 2 | A.3.8.x | | | |
| $\hat{E}_s/I_{ot}$ | dB | 1, 2 | TBD | TBD | TBD | TBD |
| $N_{oc}$ Note 2 | dBm/15 KHz | 1, 2 | TBD | | | |
| $N_{oc}$ Note 2 | dBm/SCS | 1 | TBD | | | |
| | | 2 | TBD | | | |
| SS-RSRP | dBm/SCS | 1 | TBD | TBD | TBD | TBD |
| | | 2 | TBD | TBD | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | 1, 2 | TBD | TBD | TBD | TBD |
| $Io$ | dBm/95.04MHz | 1, 2 | TBD | | TBD | |
| | Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | |

**Table A.7.6.1.4.1-5: DRX-Configuration for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps with DRX**

| Field | Value | Value | Comment |
|---|---|---|---|
| | Test1 | Test2 | |
| onDurationTimer | psf1 | psf1 | As specified in clause 6.3.2 in TS 38.331 [2] |
| drx-InactivityTimer | psf1 | psf1 | |
| drx-RetransmissionTimer | psf1 | psf1 | |
| longDRX-CycleStartOffset | Sf40 | TBD | |
| shortDRX | disable | disable | |

**Table A.7.6.1.4.1-6: *TimeAlignmentTimer* -Configuration for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps with DRX**

| Field | Value | Value | Comment |
|---|---|---|---|
| | Test1 | Test2 | |
| TimeAlignmentTimer | sf500 | sf500 | As specified in clause 6.3.2 in TS 38.331 [2] |

## A.7.6.1.4.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 7.2s for a UE supporting power class 1,
- 4.32s for a UE supporting power class 2 or 3,
- TBD for a UE supporting power class 4

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 51.2s for a UE supporting power class 1,
- 30.72s for a UE supporting power class 2 or 3,
- [30.72s] for a UE supporting power class 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

## A.7.6.2 Inter-frequency Measurements

### A.7.6.2.1 SA event triggered reporting tests For FR2 without SSB time index detection when DRX is not used (PCell in FR2)

#### A.7.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.7.6.2.1.1-1, A.7.6.2.1.1-2, and A.7.6.2.1.1-3. The TCI status for cell2 is defined in table [TBD] and TRS configuration for cell2 is defined in table [TBD].

In test 1 measurement gap pattern configuration # 0 as defined in Table A.7.6.2.1.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table A.7.6.2.1.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.1.1-1.

**Table A.7.6.2.1.1-1 SA event triggered reporting tests without SSB index reading for FR2-FR2**

| Config | Description |
|---|---|
| 1 | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note 1: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

**Table A.7.6.2.1.1-1: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection**

| Parameter | Unit | Test configuration | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| NR RF Channel Number | | Config 1 | 1, 2 | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1 | NR cell 1 (Pcell) | | NR Cell 1 is on NR RF channel number 1. |
| Neighbour cell | | Config 1 | NR cell 2 | | NR cell 2 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1 | 0 | 13 | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1 | 39 | 39 | |
| SMTC-SSB parameters | | Config 1 | SSB.3 FR2 | | As specified in clause A.3.10.2 |
| A3-Offset | dB | Config 1 | -6 | | |
| Hysteresis | dB | Config 1 | 0 | | |
| CP length | | Config 1 | Normal | | |
| TimeToTrigger | s | Config 1 | 0 | | |
| Filter coefficient | | Config 1 | 0 | | L3 filtering is not used |
| DRX | | Config 1 | OFF | | DRX is not used |
| Time offset between serving and neighbour cells | | Config 1 | 3µs | | Synchronous cells. |
| T1 | s | Config 1 | 5 | | |
| T2 | s | Config 1 | TBD | TBD | |

**Table A.7.6.2.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection**

| Parameter | | Unit | Test configuration | Cell 1 | | Cell 1 | |
|---|---|---|---|---|---|---|---|
| | | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | | Config 1 | 1 | | 2 | |
| Duplex mode | | | Config 1 | TDD | | TDD | |
| TDD configuration | | | Config 1 | TDDConf.3.1 | | TDDConf.3.1 | |
| $BW_{channel}$ | | MHz | Config 1 | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | | MHz | Config 1 | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| BWP configuration | Initial DL BWP | | Config 1 | DLBWP.0.1 | | N/A | |
| | Dedicated DL BWP | | | DLBWP.1.1 | | N/A | |
| | Dedicated UL BWP | | | ULBWP.1.1 | | N/A | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | | Config 1 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | | Config 1 | SR.3.1 TDD | | - | |
| CORESET Reference Channel | | | Config 1 | CR.3.1 TDD | | - | |
| SMTC configuration defined in A.3.11.1 and A.3.11.2 | | | Config 1 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | | kHz | Config 1 | 120 | | 120 | |
| EPRE ratio of PSS to SSS | | | Config 1 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | |
| UE orientation around TBD axis and TBD axis | | degrees | Config 1 | NA | | TBD | |
| Relative difference in angle of arrival of cell 3 relative to cell 2 | | degrees | Config 1 | NA | | NA | TBD |
| $N_{oc}$ Note2 | | dBm/15 kHz Note5 | | -98 | | -98 | |
| $N_{oc}$ Note2 | | dBm/SCS Note4 | Config 1 | -89 | | -89 | |
| SS-RSRP Note 3 | | dBm/SCS Note5 | Config 1 | -85 | -85 | -Infinity | -82 |
| $\hat{E}_s/I_{ot}$ | | dB | Config 1 | 4 | 4 | -Infinity | 7 |
| $\hat{E}_s/N_{oc}$ | | dB | Config 1 | 4 | 4 | -Infinity | 7 |
| Io Note3 | | dBm/95.04 MHz Note5 | Config 1 | -57.55 | -57.55 | -Infinity | -56.00 |
| Propagation Condition | | | Config 1 | AWGN | | | |

| | |
|---|---|
| Note 1: | OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. |
| Note 2: | Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. |
| Note 3: | SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |
| Note 4: | SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. |
| Note 5: | Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone |
| Note 6: | As observed with 0dBi gain antenna at the centre of the quiet zone |

#### A.7.6.2.1.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2x$TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.7.6.2.2 SA event triggered reporting tests For FR2 without SSB time index detection when DRX is used (PCell in FR2)

#### A.7.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.7.6.2.2.1-1, A.7.6.2.2.1-2, and A.7.6.2.2.1-3. The TCI status for cell2 is defined in table [TBD] and TRS configuration for cell2 is defined in table [TBD].

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.7.6.2.2.1-2 is provided for UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table A.7.6.2.2.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.2.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

**Table A.7.6.2.2.1-1 SA event triggered reporting tests without SSB index reading for FR2-FR2**

| Config | Description |
|---|---|
| 1 | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note 1: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

**Table A.7.6.2.2.1-1: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection**

| Parameter | Unit | Test configuration | Value | | | | Comment |
|---|---|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | Test 3 | Test 4 | |
| NR RF Channel Number | | Config 1 | 1, 2 | | | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1 | NR cell 1 (Pcell) | | | | NR Cell 1 is on NR RF channel number 1. |
| Neighbour cell | | Config 1 | NR cell 2 | | | | NR cell 2 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1 | 0 | | 13 | | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1 | 39 | | 39 | | |
| SMTC-SSB parameters | | Config 1 | SSB.3 FR2 | | | | As specified in clause A.3.10.2 |
| A3-Offset | dB | Config 1 | -6 | | | | |
| Hysteresis | dB | Config 1 | 0 | | | | |
| CP length | | Config 1 | Normal | | | | |
| TimeToTrigger | s | Config 1 | 0 | | | | |
| Filter coefficient | | Config 1 | 0 | | | | L3 filtering is not used |
| DRX | | Config 1 | DRX.1 | DRX.2 | DRX.1 | DRX.2 | DRX is used |
| Time offset between serving and neighbour cells | | Config 1 | 3µs | | | | Synchronous cells. |
| T1 | s | Config 1 | 5 | | | | |
| T2 | s | Config 1 | TBD | TBD | TBD | TBD | |

**Table A.7.6.2.2.1-3: Cell specific test parameters for CA inter-frequency event triggered reporting without SSB time index detection**

| Parameter | | Unit | Test configuration | Cell 1 T1 | Cell 1 T2 | Cell 2 T1 | Cell 2 T2 |
|---|---|---|---|---|---|---|---|
| NR RF Channel Number | | | Config 1 | 1 | | 2 | |
| TDD configuration | | | Config 1 | TDDConf.3.1 | | TDDConf.3.1 | |
| Duplex mode | | | Config 1 | TDD | | TDD | |
| $BW_{channel}$ | | MHz | Config 1 | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | | MHz | Config 1 | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| BWP configuration | Initial DL BWP | | Config 1 | DLBWP.0.1 | | N/A | |
| | Dedicated DL BWP | | | DLBWP.1.1 | | N/A | |
| | Dedicated UL BWP | | | ULBWP.1.1 | | N/A | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | | Config 1 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | | Config 1 | SR.3.1 TDD | | - | |
| CORESET Reference Channel | | | Config 1 | CR.3.1 TDD | | - | |
| SMTC configuration defined in A.3.11.1 and A.3.11.2 | | | Config 1 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | | kHz | Config 1 | 120 | | 120 | |
| EPRE ratio of PSS to SSS | | | Config 1 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | |
| UE orientation around TBD axis and TBD axis | | degrees | Config 1 | NA | | TBD | |
| Relative difference in angle of arrival of cell 3 relative to cell 2 | | degrees | Config 1 | NA | | NA | TBD |
| $N_{oc}$ Note2 | | dBm/15 kHz Note5 | | -98 | | -98 | |
| $N_{oc}$ Note2 | | dBm/SCS Note4 | Config 1 | -89 | | -89 | |
| SS-RSRP Note 3 | | dBm/SCS Note5 | Config 1 | -85 | -85 | -Infinity | -82 |
| $\hat{E}_s/I_{ot}$ | | dB | Config 1 | 4 | 4 | -Infinity | 7 |
| $\hat{E}_s/N_{oc}$ | | dB | Config 1 | 4 | 4 | -Infinity | 7 |
| Io Note3 | | dBm/95.04 MHz Note5 | Config 1 | -57.55 | -57.55 | -Infinity | -56.00 |
| Propagation Condition | | | Config 1 | AWGN | | | |

| | |
|---|---|
| Note 1: | OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. |
| Note 2: | Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. |
| Note 3: | SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |
| Note 4: | SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. |
| Note 5: | Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone |
| Note 6: | As observed with 0dBi gain antenna at the centre of the quiet zone |

#### A.7.6.2.2.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2 , 3 and 4 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.7.6.2.3 SA event triggered reporting tests For FR2 with SSB time index detection when DRX is not used (PCell in FR2)

#### A.7.6.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.7.6.2.3.1-1, A.7.6.2.3.1-2, and A.7.6.2.3.1-3. The TCI status for cell2 is defined in table [TBD] and TRS configuration for cell2 is defined in table [TBD].

In test 1 measurement gap pattern configuration # 0 as defined in Table A.7.6.2.3.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table A.7.6.2.3.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.3.1-1.

**Table A.7.6.2.3.1-1 SA event triggered reporting tests with SSB index reading for FR2-FR2**

| Config | Description |
|---|---|
| 1 | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note 1: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

**Table A.7.6.2.3.1-1: General test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection**

| Parameter | Unit | Test configuration | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| NR RF Channel Number | | Config 1 | 1, 2 | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1 | NR cell 1 (Pcell) | | NR Cell 1 is on NR RF channel number 1. |
| Neighbour cell | | Config 1 | NR cell 2 | | NR cell 2 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1 | 0 | 13 | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1 | 39 | 39 | |
| SMTC-SSB parameters | | Config 1 | SSB.3 FR2 | | As specified in clause A.3.10.2 |
| A3-Offset | dB | Config 1 | -6 | | |
| Hysteresis | dB | Config 1 | 0 | | |
| CP length | | Config 1 | Normal | | |
| TimeToTrigger | s | Config 1 | 0 | | |
| Filter coefficient | | Config 1 | 0 | | L3 filtering is not used |
| DRX | | Config 1 | OFF | | DRX is not used |
| Time offset between serving and neighbour cells | | Config 1 | 3µs | | Synchronous cells. |
| T1 | s | Config 1 | 5 | | |
| T2 | s | Config 1 | TBD | TBD | |

**Table A.7.6.2.3.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection**

| Parameter | | Unit | Test configuration | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|---|
| | | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | | Config 1 | 1 | | 2 | |
| Duplex mode | | | Config 1 | TDD | | TDD | |
| TDD configuration | | | Config 1 | TDDConf.3.1 | | TDDConf.3.1 | |
| $BW_{channel}$ | | MHz | Config 1 | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | | MHz | Config 1 | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| BWP configuration | Initial DL BWP | | Config 1 | DLBWP.0.1 | | N/A | |
| | Dedicated DL BWP | | | DLBWP.1.1 | | N/A | |
| | Dedicated UL BWP | | | ULBWP.1.1 | | N/A | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | | Config 1 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | | Config 1 | SR.3.1 TDD | | - | |
| CORESET Reference Channel | | | Config 1 | CR.3.1 TDD | | - | |
| SMTC configuration defined in A.3.11.1 and A.3.11.2 | | | Config 1 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | | kHz | Config 1 | 120 | | 120 | |
| EPRE ratio of PSS to SSS | | | Config 1 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | |
| UE orientation around TBD axis and TBD axis | | degrees | Config 1 | NA | | TBD | |
| Relative difference in angle of arrival of cell 3 relative to cell 2 | | degrees | Config 1 | NA | | NA | TBD |
| $N_{oc}$ Note2 | | dBm/15 kHz Note5 | | -98 | | -98 | |
| $N_{oc}$ Note2 | | dBm/SCS Note4 | Config 1 | -89 | | -89 | |
| SS-RSRP Note 3 | | dBm/SCS Note5 | Config 1 | -85 | -85 | -Infinity | -82 |
| $\hat{E}_s/I_{ot}$ | | dB | Config 1 | 4 | 4 | -Infinity | 7 |
| $\hat{E}_s/N_{oc}$ | | dB | Config 1 | 4 | 4 | -Infinity | 7 |
| Io Note3 | | dBm/95.04 MHz Note5 | Config 1 | -57.55 | -57.55 | -Infinity | -56.00 |
| Propagation Condition | | | Config 1 | AWGN | | | |

| | |
|---|---|
| Note 1: | OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. |
| Note 2: | Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. |
| Note 3: | SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |
| Note 4: | SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. |
| Note 5: | Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone |
| Note 6: | As observed with 0dBi gain antenna at the centre of the quiet zone |

#### A.7.6.2.3.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2x$TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.7.6.2.4 SA event triggered reporting tests For FR2 with SSB time index detection when DRX is used (PCell in FR2)

#### A.7.6.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.7.6.2.4.1-1, A.7.6.2.4.1-2, and A.7.6.2.4.1-3. The TCI status for cell2 is defined in table [TBD] and TRS configuration for cell2 is defined in table [TBD].

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.7.6.2.4.1-2 is provided for UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table A.7.6.2.4.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.4.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

**Table A.7.6.2.4.1-1: SA event triggered reporting tests with SSB index reading for FR2-FR2**

| Config | Description |
|---|---|
| 1 | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note 1: target NR cell has the same SCS, BW and duplex mode as NR serving cell | |

**Table A.7.6.2.4.1-1: General test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection**

| Parameter | Unit | Test configuration | Value | | | | Comment |
|---|---|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | Test 3 | Test 4 | |
| NR RF Channel Number | | Config 1 | 1, 2 | | | | Two FR1 NR carrier frequencies is used. |
| Active cell | | Config 1 | NR cell 1 (Pcell) | | | | NR Cell 1 is on NR RF channel number 1. |
| Neighbour cell | | Config 1 | NR cell 2 | | | | NR cell 2 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1 | 0 | | 13 | | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1 | 39 | | 39 | | |
| SMTC-SSB parameters | | Config 1 | SSB.3 FR2 | | | | As specified in clause A.3.10.2 |
| A3-Offset | dB | Config 1 | -6 | | | | |
| Hysteresis | dB | Config 1 | 0 | | | | |
| CP length | | Config 1 | Normal | | | | |
| TimeToTrigger | s | Config 1 | 0 | | | | |
| Filter coefficient | | Config 1 | 0 | | | | L3 filtering is not used |
| DRX | | Config 1 | DRX.1 | DRX.2 | DRX.1 | DRX.2 | DRX is used |
| Time offset between serving and neighbour cells | | Config 1 | 3µs | | | | Synchronous cells. |
| T1 | s | Config 1 | 5 | | | | |
| T2 | s | Config 1 | TBD | TBD | TBD | TBD | |

**Table A.7.6.2.4.1-3: Cell specific test parameters for CA inter-frequency event triggered reporting with SSB time index detection**

| Parameter | | Unit | Test configuration | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|---|
| | | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | | Config 1 | 1 | | 2 | |
| Duplex mode | | | Config 1 | TDD | | TDD | |
| TDD configuration | | | Config 1 | TDDConf.3.1 | | TDDConf.3.1 | |
| $BW_{channel}$ | | MHz | Config 1 | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | | MHz | Config 1 | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| BWP configuration | Initial DL BWP | | Config 1 | DLBWP.0.1 | | N/A | |
| | Dedicated DL BWP | | | DLBWP.1.1 | | N/A | |
| | Dedicated UL BWP | | | ULBWP.1.1 | | N/A | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | | Config 1 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | | Config 1 | SR.3.1 TDD | | - | |
| CORESET Reference Channel | | | Config 1 | CR.3.1 TDD | | - | |
| SMTC configuration defined in A.3.11.1 and A.3.11.2 | | | Config 1 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | | kHz | Config 1 | 120 | | 120 | |
| EPRE ratio of PSS to SSS | | | Config 1 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | |
| UE orientation around TBD axis and TBD axis | | degrees | Config 1 | NA | | TBD | |
| Relative difference in angle of arrival of cell 3 relative to cell 2 | | degrees | Config 1 | NA | | NA | TBD |
| $N_{oc}$ Note2 | | dBm/15 kHz Note5 | | -98 | | -98 | |
| $N_{oc}$ Note2 | | dBm/SCS Note4 | Config 1 | -89 | | -89 | |
| SS-RSRP Note 3 | | dBm/SCS Note5 | Config 1 | -85 | -85 | -Infinity | -82 |
| $\hat{E}_s/I_{ot}$ | | dB | Config 1 | 4 | 4 | -Infinity | 7 |
| $\hat{E}_s/N_{oc}$ | | dB | Config 1 | 4 | 4 | -Infinity | 7 |
| Io Note3 | | dBm/95.04 MHz Note5 | Config 1 | -57.55 | -57.55 | -Infinity | -56.00 |
| Propagation Condition | | | Config 1 | AWGN | | | |

| | |
|---|---|
| Note 1: | OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. |
| Note 2: | Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. |
| Note 3: | SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |
| Note 4: | SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. |
| Note 5: | Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone |
| Note 6: | As observed with 0dBi gain antenna at the centre of the quiet zone |

#### A.7.6.2.4.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2 , 3 and 4 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.7.6.2.5 SA event triggered reporting tests for FR2 without SSB time index detection when DRX is not used (PCell in FR1)

#### A.7.6.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2.  The test parameters and configurations are given in Tables A.7.6.2.5.1-1, A.7.6.2.5.1-2, and A.7.6.2.5.1-3. The TCI status for cell2 is defined in table [TBD] and TRS configuration for cell2 is defined in table [TBD].

In test 1 measurement gap pattern configuration # 0 as defined in Table A.7.6.2.5.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table A.7.6.2.5.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

Supported test configurations are shown in table A.7.6.2.5.1-1.

**Table A.7.6.2.5.1-1 SA event triggered reporting tests without SSB index reading for FR1-FR2**

| Config | Description of serving cell | Description of target cell |
|---|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | |
| 3 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | |
| Note: The UE is only required to be tested in one of the supported test configurations | | |

**Table A.7.6.2.5.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection**

| Parameter | Unit | Test configuration | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| NR RF Channel Number | | Config 1,2,3 | 1, 2 | | Two NR carrier frequencies is used. |
| Active cell | | Config 1,2,3 | NR cell 1 (Pcell) | | NR Cell 1 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3 | NR cell 2 | | NR cell 2 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3 | 0 | 13 | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3 | 39 | 39 | |
| SMTC-SSB parameters on NR RF Channel 1 | | Config 1 | SSB.1 FR1 | | As specified in clause A.3.10.1 |
| | | Config 2 | SSB.1 FR1 | | As specified in clause A.3.10.1 |
| | | Config 3 | SSB.2 FR1 | | As specified in clause A.3.10.1 |
| SMTC-SSB parameters on NR RF Channel 2 | | Config 1,2,3 | SSB.3 FR2 | | As specified in clause A.3.10.2 |
| *offsetMO* | dB | Config 1,2,3 | 6 | | |
| Hysteresis | dB | Config 1,2,3 | 0 | | |
| *a4-Threshold* | dBm | Config 1,2,3 | TBD | | |
| CP length | | Config 1,2,3 | Normal | | |
| TimeToTrigger | s | Config 1,2,3 | 0 | | |
| Filter coefficient | | Config 1,2,3 | 0 | | L3 filtering is not used |
| DRX | | Config 1,2,3 | OFF | | DRX is not used |
| Time offset between serving and neighbour cells | | Config 1 | 3ms | | Asynchronous cells.<br>The timing of Cell 2 is 3ms later than the timing of Cell 1. |
| | | Config 2,3 | 3μs | | Synchronous cells. |
| T1 | s | Config 1,2,3 | 5 | | |
| T2 | s | Config 1,2,3 | TBD | TBD | |

**Table A.7.6.2.5.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection**

| Parameter | | Unit | Test configuration | Cell 1 T1 | Cell 1 T2 | Cell 2 T1 | Cell 2 T2 |
|---|---|---|---|---|---|---|---|
| NR RF Channel Number | | | Config 1,2,3 | 1 | | 2 | |
| Duplex mode | | | Config 1 | FDD | | TDD | |
| | | | Config 2,3 | TDD | | TDD | |
| TDD configuration | | | Config 1 | Not Applicable | | TDDConf.3.1 | |
| | | | Config 2 | TDDConf.1.1 | | TDDConf.3.1 | |
| | | | Config 3 | TDDConf.2.1 | | TDDConf.3.1 | |
| $BW_{channel}$ | | MHz | Config 1 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | | Config 2 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | | Config 3 | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | | MHz | Config 1 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | | Config 2 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | | Config 3 | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| BWP configuration | Initial DL BWP | | Config 1,2,3 | DLBWP.0.1 | | N/A | |
| | Dedicated DL BWP | | | DLBWP.1.1 | | N/A | |
| | Dedicated UL BWP | | | ULBWP.1.1 | | N/A | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | | Config 1,2,3 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | | Config 1 | SR.1.1 FDD | | - | |
| | | | Config 2 | SR.1.1 TDD | | | |
| | | | Config 3 | SR2.1 TDD | | | |
| CORESET Reference Channel | | | Config 1 | CR.1.1 FDD | | - | |
| | | | Config 2 | CR.1.1 TDD | | | |
| | | | Config 3 | CR2.1 TDD | | | |
| SMTC configuration defined in A.3.11.1 and A.3.11.2 | | | Config 1 | SMTC.2 | | SMTC.2 | |
| | | | Config 2,3 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | | kHz | Config 1,2 | 15 | | 120 | |
| | | | Config 3 | 30 | | 120 | |
| EPRE ratio of PSS to SSS | | | Config 1,2,3 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | |
| UE orientation around TBD axis and TBD axis | | degrees | Config 1,2,3 | NA | | TBD | |
| Relative difference in angle of arrival of cell 3 relative to cell 2 | | degrees | Config 1,2,3 | NA | | NA | TBD |
| $N_{oc}$ Note2 | | dBm/15 kHz Note5 | | NA | | TBD | |
| $N_{oc}$ Note2 | | dBm/SCS Note4 | Config 1,2 | NA | | NA | |
| | | | Config 3 | NA | | NA | |
| SS-RSRP Note 3 | | | Config 1,2 | NA | NA | TBD | TBD |

| | | | | | | |
|---|---|---|---|---|---|---|
| | dBm/SCS Note5 | Config 3 | NA | NA | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2,3 | NA | NA | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2,3 | NA | NA | TBD | TBD |
| Io[Note3] | dBm/9.36MHz | Config 1,2 | NA | NA | - | - |
| | dBm/38.16MHz | Config 3 | NA | NA | - | - |
| | dBm/95.04 MHz Note5 | Config 1,2,3 | - | - | TBD | TBD |
| Propagation Condition | | Config 1,2,3 | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 6: As observed with 0dBi gain antenna at the centre of the quiet zone | | | | | | |

#### A.7.6.2.5.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to 2x$TTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.7.6.2.6 SA event triggered reporting tests for FR2 without SSB time index detection when DRX is used (PCell in FR1)

#### A.7.6.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.7.6.2.6.1-1, A.7.6.2.6.1-2, and A.7.6.2.6.1-3. The TCI status for cell2 is defined in table [TBD] and TRS configuration for cell2 is defined in table [TBD].

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.7.6.2.6.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table A.7.6.2.6.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

Supported test configurations are shown in table A.7.6.2.6.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

**Table A.7.6.2.6.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR2**

| Config | Description of serving cell | Description of target cell |
|---|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | |
| 3 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | |
| Note: The UE is only required to be tested in one of the supported test configurations | | |

**Table A.7.6.2.6.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection**

| Parameter | Unit | Test configuration | Value | | | | Comment |
|---|---|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | Test 3 | Test 4 | |
| NR RF Channel Number | | Config 1,2,3 | 1, 2 | | | | Two NR carrier frequencies is used. |
| Active cell | | Config 1,2,3 | NR cell 1 (Pcell) | | | | NR Cell 1 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3 | NR cell 2 | | | | NR cell 2 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3 | 0 | | 13 | | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3 | 39 | | 39 | | |
| SMTC-SSB parameters on NR RF Channel 1 | | Config 1 | SSB.1 FR1 | | | | As specified in clause A.3.10.1 |
| | | Config 2 | SSB.1 FR1 | | | | As specified in clause A.3.10.1 |
| | | Config 3 | SSB.2 FR1 | | | | As specified in clause A.3.10.1 |
| SMTC-SSB parameters on NR RF Channel 2 | | Config 1,2,3 | SSB.3 FR2 | | | | As specified in clause A.3.10.2 |
| *offsetMO* | dB | Config 1,2,3 | 6 | | | | |
| Hysteresis | dB | Config 1,2,3 | 0 | | | | |
| *a4-Threshold* | dBm | Config 1,2,3 | TBD | | | | |
| CP length | | Config 1,2,3 | Normal | | | | |
| TimeToTrigger | s | Config 1,2,3 | 0 | | | | |
| Filter coefficient | | Config 1,2,3 | 0 | | | | L3 filtering is not used |
| DRX | | Config 1,2,3 | DRX.1 | DRX.2 | DRX.1 | DRX.2 | DRX is used |
| Time offset between serving and neighbour cells | | Config 1 | 3ms | | | | Asynchronous cells.<br>The timing of Cell 2 is 3ms later than the timing of Cell 1. |
| | | Config 2,3 | 3µs | | | | Synchronous cells. |
| T1 | s | Config 1,2,3 | 5 | | | | |
| T2 | s | Config 1,2,3 | TBD | | TBD | | |

**Table A.7.6.2.6.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection**

| Parameter | | Unit | Test configuration | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|---|
| | | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | | Config 1,2,3 | 1 | | 2 | |
| Duplex mode | | | Config 1 | FDD | | TDD | |
| | | | Config 2,3 | TDD | | TDD | |
| TDD configuration | | | Config 1 | Not Applicable | | TDDConf.3.1 | |
| | | | Config 2 | TDDConf.1.1 | | TDDConf.3.1 | |
| | | | Config 3 | TDDConf.2.1 | | TDDConf.3.1 | |
| $BW_{channel}$ | | MHz | Config 1 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | | Config 2 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | | Config 3 | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | | MHz | Config 1 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | | Config 2 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | | Config 3 | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| BWP configuration | Initial DL BWP | | Config 1,2,3 | DLBWP.0.1 | | N/A | |
| | Dedicated DL BWP | | | DLBWP.1.1 | | N/A | |
| | Dedicated UL BWP | | | ULBWP.1.1 | | N/A | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | | Config 1,2,3 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | | Config 1 | SR.1.1 FDD | | - | |
| | | | Config 2 | SR.1.1 TDD | | | |
| | | | Config 3 | SR2.1 TDD | | | |
| CORESET Reference Channel | | | Config 1 | CR.1.1 FDD | | - | |
| | | | Config 2 | CR.1.1 TDD | | | |
| | | | Config 3 | CR2.1 TDD | | | |
| SMTC configuration defined in A.3.11.1 and A.3.11.2 | | | Config 1 | SMTC.2 | | SMTC.2 | |
| | | | Config 2,3 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | | kHz | Config 1,2 | 15 | | 120 | |
| | | | Config 3 | 30 | | 120 | |
| EPRE ratio of PSS to SSS | | | Config 1,2,3 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | |
| UE orientation around TBD axis and TBD axis | | degrees | Config 1,2,3 | NA | | TBD | |
| Relative difference in angle of arrival of cell 3 relative to cell 2 | | degrees | Config 1,2,3 | NA | | NA | TBD |
| $N_{oc}$ Note2 | | dBm/15 kHz Note5 | | NA | | TBD | |
| $N_{oc}$ Note2 | | dBm/SCS Note4 | Config 1,2 | NA | | TBD | |
| | | | Config 3 | NA | | TBD | |
| SS-RSRP Note 3 | | | Config 1,2 | NA | NA | TBD | TBD |

| | | | | | | |
|---|---|---|---|---|---|---|
| | dBm/SCS Note5 | Config 3 | NA | NA | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2,3 | NA | NA | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2,3 | NA | NA | TBD | TBD |
| Io[Note3] | dBm/9.36MHz | Config 1,2 | NA | NA | - | - |
| | dBm/38.16MHz | Config 3 | NA | NA | - | - |
| | dBm/95.04 MHz Note5 | Config 1,2,3 | - | - | TBD | TBD |
| Propagation Condition | | Config 1,2,3 | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 6: As observed with 0dBi gain antenna at the centre of the quiet zone | | | | | | |

#### A.7.6.2.6.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-UE gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2 , 3 and 4 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.7.6.2.7 SA event triggered reporting tests for FR2 with SSB time index detection when DRX is not used (PCell in FR1)

#### A.7.6.2.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.7.6.2.7.1-1, A.7.6.2.7.1-2, and

A.7.6.2.7.1-3. The TCI status for cell2 is defined in table [TBD] and TRS configuration for cell2 is defined in table [TBD].

In test 1 measurement gap pattern configuration # 0 as defined in Table A.7.6.2.7.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table A.7.6.2.7.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

Supported test configurations are shown in table A.7.6.2.7.1-1.

**Table A.7.6.2.7.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR2**

| Config | Description of serving cell | Description of target cell |
|---|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | |
| 3 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | |
| Note: The UE is only required to be tested in one of the supported test configurations | | |

**Table A.7.6.2.7.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection**

| Parameter | Unit | Test configuration | Value | | Comment |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | |
| NR RF Channel Number | | Config 1,2,3 | 1, 2 | | Two NR carrier frequencies is used. |
| Active cell | | Config 1,2,3 | NR cell 1 (Pcell) | | NR Cell 1 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3 | NR cell 2 | | NR cell 2 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3 | 0 | 13 | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3 | 39 | 39 | |
| SMTC-SSB parameters on NR RF Channel 1 | | Config 1 | SSB.1 FR1 | | As specified in clause A.3.10.1 |
| | | Config 2 | SSB.1 FR1 | | As specified in clause A.3.10.1 |
| | | Config 3 | SSB.2 FR1 | | As specified in clause A.3.10.1 |
| SMTC-SSB parameters on NR RF Channel 2 | | Config 1,2,3 | SSB.3 FR2 | | As specified in clause A.3.10.2 |
| *offsetMO* | dB | Config 1,2,3 | 6 | | |
| Hysteresis | dB | Config 1,2,3 | 0 | | |
| *a4-Threshold* | dBm | Config 1,2,3,4,5,6 | TBD | | |
| CP length | | Config 1,2,3 | Normal | | |
| TimeToTrigger | s | Config 1,2,3 | 0 | | |
| Filter coefficient | | Config 1,2,3 | 0 | | L3 filtering is not used |
| DRX | | Config 1,2,3 | OFF | | DRX is not used |
| Time offset between serving and neighbour cells | | Config 1 | 3ms | | Asynchronous cells.<br>The timing of Cell 2 is 3ms later than the timing of Cell 1. |
| | | Config 2,3 | 3µs | | Synchronous cells. |
| T1 | s | Config 1,2,3 | 5 | | |
| T2 | s | Config 1,2,3 | TBD | TBD | |

**Table A.7.6.2.7.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection**

| Parameter | | Unit | Test configuration | Cell 1 T1 | Cell 1 T2 | Cell 2 T1 | Cell 2 T2 |
|---|---|---|---|---|---|---|---|
| NR RF Channel Number | | | Config 1,2,3 | 1 | | 2 | |
| Duplex mode | | | Config 1 | FDD | | TDD | |
| | | | Config 2,3 | TDD | | TDD | |
| TDD configuration | | | Config 1 | Not Applicable | | TDDConf.3.1 | |
| | | | Config 2 | TDDConf.1.1 | | TDDConf.3.1 | |
| | | | Config 3 | TDDConf.2.1 | | TDDConf.3.1 | |
| $BW_{channel}$ | | MHz | Config 1 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | | Config 2 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | | Config 3 | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | | MHz | Config 1 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | | Config 2 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | | Config 3 | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| BWP configuration | Initial DL BWP | | Config 1,2,3 | DLBWP.0.1 | | N/A | |
| | Dedicated DL BWP | | | DLBWP.1.1 | | N/A | |
| | Dedicated UL BWP | | | ULBWP.1.1 | | N/A | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | | Config 1,2,3 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | | Config 1 | SR.1.1 FDD | | - | |
| | | | Config 2 | SR.1.1 TDD | | | |
| | | | Config 3 | SR2.1 TDD | | | |
| CORESET Reference Channel | | | Config 1 | CR.1.1 FDD | | - | |
| | | | Config 2 | CR.1.1 TDD | | | |
| | | | Config 3 | CR2.1 TDD | | | |
| SMTC configuration defined in A.3.11.1 and A.3.11.2 | | | Config 1 | SMTC.2 | | SMTC.2 | |
| | | | Config 2,3 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | | kHz | Config 1,2 | 15 | | 120 | |
| | | | Config 3 | 30 | | 120 | |
| EPRE ratio of PSS to SSS | | | Config 1,2,3 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | |
| UE orientation around TBD axis and TBD axis | | degrees | Config 1,2,3 | NA | | TBD | |
| Relative difference in angle of arrival of cell 3 relative to cell 2 | | degrees | Config 1,2,3 | NA | | NA | TBD |
| $N_{oc}$ Note2 | | dBm/15 kHz Note5 | | NA | | NA | |
| $N_{oc}$ Note2 | | dBm/SCS Note4 | Config 1,2 | NA | | NA | |
| | | | Config 3 | NA | | NA | |
| SS-RSRP Note 3 | | | Config 1,2 | NA | NA | TBD | TBD |

| | | | | | | |
|---|---|---|---|---|---|---|
| | dBm/SCS Note5 | Config 3 | NA | NA | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2,3 | NA | NA | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2,3 | NA | NA | TBD | TBD |
| Io[Note3] | dBm/9.36MHz | Config 1,2 | NA | NA | - | - |
| | dBm/38.16MHz | Config 3 | NA | NA | - | - |
| | dBm/95.04 MHz Note5 | Config 1,2,3 | - | - | TBD | TBD |
| Propagation Condition | | Config 1,2,3 | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 6: As observed with 0dBi gain antenna at the centre of the quiet zone | | | | | | |

#### A.7.6.2.7.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

### A.7.6.2.8 SA event triggered reporting tests for FR2 with SSB time index detection when DRX is used (PCell in FR1)

#### A.7.6.2.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.7.6.2.8.1-1, A.7.6.2.8.1-2, and A.7.6.2.8.1-3. The TCI status for cell2 is defined in table [TBD] and TRS configuration for cell2 is defined in table [TBD].

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.7.6.2.8.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table A.7.6.2.8.1-2 is provided for UE that support per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

Supported test configurations are shown in table A.7.6.2.8.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

**Table A.7.6.2.8.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR2**

| Config | Description of serving cell | Description of target cell |
|---|---|---|
| 1 | NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode | |
| 3 | NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode | |
| Note: The UE is only required to be tested in one of the supported test configurations | | |

**Table A.7.6.2.8.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection**

| Parameter | Unit | Test configuration | Value | | | | Comment |
|---|---|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | Test 3 | Test 4 | |
| NR RF Channel Number | | Config 1,2,3 | 1, 2 | | | | Two NR carrier frequencies is used. |
| Active cell | | Config 1,2,3 | NR cell 1 (Pcell) | | | | NR Cell 1 is on NR RF channel number 1. |
| Neighbour cell | | Config 1,2,3 | NR cell 2 | | | | NR cell 2 is on NR RF channel number 2. |
| Gap Pattern Id | | Config 1,2,3 | 0 | | 13 | | As specified in clause 9.1.2-1. |
| Measurement gap offset | | Config 1,2,3 | 39 | | 39 | | |
| SMTC-SSB parameters on NR RF Channel 1 | | Config 1 | SSB.1 FR1 | | | | As specified in clause A.3.10.1 |
| | | Config 2 | SSB.1 FR1 | | | | As specified in clause A.3.10.1 |
| | | Config 3 | SSB.2 FR1 | | | | As specified in clause A.3.10.1 |
| SMTC-SSB parameters on NR RF Channel 2 | | Config 1,2,3 | SSB.3 FR2 | | | | As specified in clause A.3.10.2 |
| *offsetMO* | dB | Config 1,2,3 | 6 | | | | |
| Hysteresis | dB | Config 1,2,3 | 0 | | | | |
| *a4-Threshold* | dBm | Config 1,2,3 | TBD | | | | |
| CP length | | Config 1,2,3 | Normal | | | | |
| TimeToTrigger | s | Config 1,2,3 | 0 | | | | |
| Filter coefficient | | Config 1,2,3 | 0 | | | | L3 filtering is not used |
| DRX | | Config 1,2,3 | DRX.1 | DRX.2 | DRX.1 | DRX.2 | DRX is used |
| Time offset between serving and neighbour cells | | Config 1 | 3ms | | | | Asynchronous cells.<br>The timing of Cell 2 is 3ms later than the timing of Cell 1. |
| | | Config 2,3 | 3μs | | | | Synchronous cells. |
| T1 | s | Config 1,2,3 | 5 | | | | |
| T2 | s | Config 1,2,3 | TBD | | TBD | | |

**Table A.7.6.2.8.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection**

| Parameter | | Unit | Test configuration | Cell 1 | | Cell 2 | |
|---|---|---|---|---|---|---|---|
| | | | | T1 | T2 | T1 | T2 |
| NR RF Channel Number | | | Config 1,2,3 | 1 | | 2 | |
| Duplex mode | | | Config 1 | FDD | | TDD | |
| | | | Config 2,3 | TDD | | TDD | |
| TDD configuration | | | Config 1 | Not Applicable | | TDDConf.3.1 | |
| | | | Config 2 | TDDConf.1.1 | | TDDConf.3.1 | |
| | | | Config 3 | TDDConf.2.1 | | TDDConf.3.1 | |
| $BW_{channel}$ | | MHz | Config 1 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | | Config 2 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | | Config 3 | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| BWP BW | | MHz | Config 1 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | | Config 2 | 10: $N_{RB,c}$ = 52 | | 100: $N_{RB,c}$ = 66 | |
| | | | Config 3 | 40: $N_{RB,c}$ = 106 | | 100: $N_{RB,c}$ = 66 | |
| BWP configuration | Initial DL BWP | | Config 1,2,3 | DLBWP.0.1 | | N/A | |
| | Dedicated DL BWP | | | DLBWP.1.1 | | N/A | |
| | Dedicated UL BWP | | | ULBWP.1.1 | | N/A | |
| OCNG Patterns defined in A.3.2.1.1 (OP.1) | | | Config 1,2,3 | OP.1 | | OP.1 | |
| PDSCH Reference measurement channel | | | Config 1 | SR.1.1 FDD | | - | |
| | | | Config 2 | SR.1.1 TDD | | | |
| | | | Config 3 | SR2.1 TDD | | | |
| CORESET Reference Channel | | | Config 1 | CR.1.1 FDD | | - | |
| | | | Config 2 | CR.1.1 TDD | | | |
| | | | Config 3 | CR2.1 TDD | | | |
| SMTC configuration defined in A.3.11.1 and A.3.11.2 | | | Config 1 | SMTC.2 | | SMTC.2 | |
| | | | Config 2,3 | SMTC.1 | | SMTC.1 | |
| PDSCH/PDCCH subcarrier spacing | | kHz | Config 1,2 | 15 | | 120 | |
| | | | Config 3 | 30 | | 120 | |
| EPRE ratio of PSS to SSS | | | Config 1,2,3 | 0 | | 0 | |
| EPRE ratio of PBCH DMRS to SSS | | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | | |
| EPRE ratio of PDSCH to PDSCH | | | | | | | |
| EPRE ratio of OCNG DMRS to SSS(Note 1) | | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) | | | | | | | |
| UE orientation around TBD axis and TBD axis | | degrees | Config 1,2,3 | NA | | TBD | |
| Relative difference in angle of arrival of cell 3 relative to cell 2 | | degrees | Config 1,2,3 | NA | | NA | TBD |
| $N_{oc}$ Note2 | | dBm/15 kHz Note5 | | NA | | NA | |
| $N_{oc}$ Note2 | | dBm/SCS Note4 | Config 1,2 | NA | | NA | |
| | | | Config 3 | NA | | NA | |
| SS-RSRP Note 3 | | | Config 1,2 | NA | NA | TBD | TBD |

| | | | | | | |
|---|---|---|---|---|---|---|
| | dBm/SCS Note5 | Config 3 | NA | NA | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | dB | Config 1,2,3 | NA | NA | TBD | TBD |
| $\hat{E}_s/N_{oc}$ | dB | Config 1,2,3 | NA | NA | TBD | TBD |
| Io Note3 | dBm/9.36MHz | Config 1,2 | NA | NA | - | - |
| | dBm/38.16MHz | Config 3 | NA | NA | - | - |
| | dBm/95.04 MHz Note5 | Config 1,2,3 | - | - | TBD | TBD |
| Propagation Condition | | Config 1,2,3 | AWGN | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 6: As observed with 0dBi gain antenna at the centre of the quiet zone | | | | | | |

#### A.7.6.2.8.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-UE gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than [TBD] ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2 , 3 and 4 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

# A.7.7 Measurement Performance requirements

## A.7.7.1 SS-RSRP

### A.7.7.1.1 intra-frequency case

#### A.7.7.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 10.1.2.1.1and 10.1.2.1.1 for intra-frequency measurements.

#### A.7.7.1.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.7.7.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra frequency measurements are tested by using the parameters in Table A.7.7.1.1.2-2 and A.7.7.1.1.2-3. In all test cases, Cell 1 is the PCell and Cell 2 the target cell. The TCI status for Cell 1 is defined in Table [TBD] and TRS configuration for Cell 1 is defined in Table [TBD].

**Table A.7.7.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

**Table A.7.7.1.1.2-2: SS-RSRP Intra frequency general test parameters**

| Parameter | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|
| | | Cell 1 | Cell 2 | Cell 1 | Cell 2 | Cell 1 | Cell 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SSB ARFCN | | freq1 | | freq1 | | freq1 | |
| Duplex mode | | TDD | | TDD | | TDD | |
| TDD configuration | | TDDConf.3.1 | | TDDConf.3.1 | | TDDConf.3.1 | |
| $BW_{channel}$ | MHz | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| Downlink initial BWP configuration | | DLBWP.0 | | | | | |
| Downlink dedicated BWP configuration | | DLBWP.1 | | | | | |
| Uplink dedicated BWP configuration | | ULBWP.1 | | | | | |
| DRX Cycle | ms | Not Applicable | | | | | |
| PDSCH Reference measurement channel | | SR.3.1 TDD | - | SR.3.1 TDD | - | SR.3.1 TDD | - |
| RMSI CORESET Reference Channel | | CR.3.1 TDD | - | CR.3.1 TDD | - | CR.3.1 TDD | - |
| Control channel RMC | | CCR.3.1 TDD | - | CCR.3.1 TDD | - | CCR.3.1 TDD | - |
| OCNG Patterns | | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 |
| SSB configuration | | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 |
| SMTC configuration | | SMTC.1 | SMTC.1 | SMTC.1 | SMTC.1 | SMTC.1 | SMTC.1 |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | 120 | 120 | 120 | 120 | 120 |
| EPRE ratio of PSS to SSS<br>EPRE ratio of PBCH_DMRS to SSS<br>EPRE ratio of PBCH to PBCH_DMRS<br>EPRE ratio of PDCCH_DMRS to SSS<br>EPRE ratio of PDCCH to PDCCH_DMRS<br>EPRE ratio of PDSCH_DMRS to SSS<br>EPRE ratio of PDSCH to PDSCH_DMRS<br>EPRE ratio of OCNG DMRS to SSS Note 1<br>EPRE ratio of OCNG to OCNG DMRS Note 1 | dB | 0 | 0 | 0 | 0 | 0 | 0 |
| $\hat{E}_s/N_{oc}$ | dB | 6 | 1 | 6 | 1 | 3 | -1 |
| Propagation conditions | | AWGN | | | | | |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

**Table A.7.7.1.1.2-3: SS-RSRP Intra frequency OTA related test parameters**

| Parameter | | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|---|
| | | | Cell 1 | Cell 2 | Cell 1 | Cell 2 | Cell 1 | Cell 2 |
| Angle of arrival configuration | | | According to section TBD | | According to section TBD | | According to section TBD | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/15kHz Note4 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/SCS Note 3 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SS-RSRP Note2 | NR_TDD_FR2_A | dBm/SCS Note4 | TBD | TBD | TBD | TBD | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD | TBD |
| | NR_TDD_FR2_F | | | | | | TBD | TBD |
| | NR_TDD_FR2_G | | | | | | TBD | TBD |
| | NR_TDD_FR2_T | | | | | | TBD | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| Io Note2 | NR_TDD_FR2_A | dBm/95.04 MHz Note4 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone | | | | | | | | |

#### A.7.7.1.1.3 Test Requirements

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in sections 10.1.3.1.1 and relative accuracy requirements in section 10.1.3.1.2.

### A.7.7.1.2 SA inter-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

#### A.7.7.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 10.1.5.1.1 and 10.1.5.1.2 for intra frequency measurements with the testing configurations for NR cells in Table A.7.7.1.2.1-1.

**Table A.7.7.1.2.1-1: Applicable NR configurations for FR2 inter-frequency SS-RSRP accuracy test**

| Configuration | Description |
|---|---|
| 1 | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

#### A.7.7.1.2.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on a different frequency than the PCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 1 and Cell 2 are given in Table A.7.7.1.2.2-1 and Table A.7.7.1.2.2-2 below. Both absolute and relative accuracy of RSRP intra frequency measurements are tested by using the parameters in Table A.7.7.1.2.2-1 and Table A.7.7.1.2.2-1. The inter frequency measurements are supported by a measurement gap. The TCI status for Cell 1 is defined in Table [TBD] and TRS configuration for Cell 1 is defined in Table [TBD].

**Table A.7.7.1.2.2-1: SS-RSRP inter-frequency test parameters**

| Parameter | Config | Unit | Test 1 | | Test 2 | |
|---|---|---|---|---|---|---|
| | | | Cell 1 | Cell 2 | Cell 1 | Cell 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| SSB ARFCN | 1~2 | | freq1 | freq2 | freq1 | freq2 |
| $BW_{channel}$ | 1~2 | | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| Duplex mode | 1~2 | | TDD | TDD | TDD | TDD |
| TDD configuration | 1~2 | | TDDConf.3.1 | | TDDConf.3.1 | |
| PDSCH Reference measurement channel | 1~2 | | SR.3.1 TDD | - | SR.3.1 TDD | - |
| RMSI CORESET Reference Channel | 1~2 | | CR.3.1 TDD | - | CR.3.1 TDD | - |
| Dedicated CORESET Reference Channel | 1~2 | | CCR.3.1 TDD | - | CCR.3.1 TDD | - |
| SSB configuration | 1 | | SSB.1 FR2 | | SSB.1 FR2 | |
| | 2 | | SSB.2 FR2 | | SSB.2 FR2 | |
| OCNG Patterns | 1~2 | | OP.1 | | OP.1 | |
| DL BWP | 1~2 | | DLBWP.1.1 | | DLBWP.1.1 | |
| UL BWP | 1~2 | | ULBWP.1.1 | | ULBWP.1.1 | |
| SMTC configuration | 1~2 | | SMTC.1 | | SMTC.1 | |
| EPRE ratio of PSS to SSS | 1~2 | dB | 0 | 0 | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | | | | | |
| EPRE ratio of OCNG DMRS to SSS Note 1 | | | | | | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 | | | | | | |
| Propagation condition | 1~2 | - | AWGN | | AWGN | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. | | | | | | |

**Table A.7.7.1.2.2-2: SS-RSRP inter-frequency OTA test parameters**

| Parameter | | Config | Unit | Test 1 | | Test 2 | |
|---|---|---|---|---|---|---|---|
| | | | | Cell 1 | Cell 2 | Cell 1 | Cell 2 |
| $N_{oc}$ | NR_TDD_FR2_A | 1~2 | dBm/15 kHz | TBD | | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD |
| | NR_TDD_FR2_F | | | | | | TBD |
| | NR_TDD_FR2_G | | | | | | TBD |
| | NR_TDD_FR2_T | | | | | | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD |
| $N_{oc}$ | NR_TDD_FR2_A | 1 | dBm/SSB SCS | TBD | | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD |
| | NR_TDD_FR2_F | | | | | | TBD |
| | NR_TDD_FR2_G | | | | | | TBD |
| | NR_TDD_FR2_T | | | | | | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD |
| | NR_TDD_FR2_A | 2 | | TBD | | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD |
| | NR_TDD_FR2_F | | | | | | TBD |
| | NR_TDD_FR2_G | | | | | | TBD |
| | NR_TDD_FR2_T | | | | | | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $\hat{E}_s/I_{ot}$ | | 1~2 | dB | TBD | TBD | TBD | TBD |
| SS-RSRP[Note1] | NR_TDD_FR2_A | 1 | dBm/SCS | TBD | | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD |
| | NR_TDD_FR2_F | | | | | | TBD |
| | NR_TDD_FR2_G | | | | | | TBD |
| | NR_TDD_FR2_T | | | | | | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD |
| | NR_TDD_FR2_A | 2 | | TBD | | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD |
| | NR_TDD_FR2_F | | | | | | TBD |
| | NR_TDD_FR2_G | | | | | | TBD |
| | NR_TDD_FR2_T | | | | | | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD |
| Io[Note1] | NR_TDD_FR2_A | 1~2 | dBm/95.04MHz | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | TBD | |
| $\hat{E}_s/N_{oc}$ | | 1~2 | dB | TBD | TBD | TBD | TBD |
| Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | | | |

#### A.7.7.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil the Abosute requirements in sections 10.1.5.1.1 and Relative requirements in section 10.1.5.1.2.

## A.7.7.2 SS-RSRQ

### A.7.7.2.1 Intra-frequency case

#### A.7.7.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.8.1.1.

#### A.7.7.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in Table A.7.7.2.1.2-1. . The absolute accuracy of SS-RSRQ intra-frequency measurement is test by using the parameters in Table A.7.7.2.1.2-2 and Table A.7.7.2.1.2-3. In all test cases, Cell 1 is the PCell and Cell 2 the target cell.

**Table A.7.7.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

**Table A.7.7.2.1.2-2: SS-RSRQ Intra frequency test parameters**

| Parameter | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|
| | | Cell 1 | Cell 2 | Cell 1 | Cell 2 | Cell 1 | Cell 2 |
| SSB ARFCN | | Freq2 | | Freq2 | | Freq2 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Duplex mode | | TDD | | TDD | | TDD | |
| TDD configuration | | TDDConf.3.1 | | TDDConf.3.1 | | TDDConf.3.1 | |
| $BW_{channel}$ | MHz | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| PDSCH Reference measurement channel | | SR.3.1 TDD | | SR.3.1 TDD | | SR.3.1 TDD | |
| RMSI CORESET Reference Channel | | CR.3.1 TDD | - | CR.3.1 TDD | - | CR.3.1 TDD | |
| Dedicated RMSI CORESET Reference Channel | | CCR.3.1 TDD | - | CCR.3.1 TDD | - | CCR.3.1 TDD | - |
| OCNG Patterns | | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 |
| SMTC configuration | | SMTC.1 | | | | | |
| SSB configuration | | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 | SSB.1 FR2 |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | 120 | 120 | 120 | 120 | 120 |
| SS-RSSI-Measurement | | Not Applicable | | | | | |
| EPRE ratio of PSS to SSS<br>EPRE ratio of PBCH_DMRS to SSS<br>EPRE ratio of PBCH to PBCH_DMRS<br>EPRE ratio of PDCCH_DMRS to SSS<br>EPRE ratio of PDCCH to PDCCH_DMRS<br>EPRE ratio of PDSCH_DMRS to SSS<br>EPRE ratio of PDSCH to PDSCH_DMRS<br>EPRE ratio of OCNG DMRS to SSS Note 1<br>EPRE ratio of OCNG to OCNG DMRS Note 1 | dB | 0 | 0 | 0 | 0 | 0 | 0 |
| $\hat{E}_s/N_{oc}$ | dB | 3 | 3 | -2.9 | -2.9 | -4 | -4 |

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.
Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

**Table A.7.7.2.1.2-3: SS-RSRQ Intra frequency OTA related test parameters**

| Parameter | | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|---|
| | | | Cell 1 | Cell 2 | Cell 1 | Cell 2 | Cell 1 | Cell 2 |
| Angle of arrival configuration | | | According to section A.3.8.X | | According to section A.3.8.X | | According to section A.3.8.X | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/15kHz Note4 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/SCS Note 3 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| SS-RSRP Note2 | NR_TDD_FR2_A | dBm/SCS Note4 | TBD | TBD | TBD | TBD | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD | TBD |
| | NR_TDD_FR2_F | | | | | | TBD | TBD |
| | NR_TDD_FR2_G | | | | | | TBD | TBD |
| | NR_TDD_FR2_T | | | | | | TBD | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD | TBD |
| SS-RSRQ Note2 | NR_TDD_FR2_A | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD | TBD |
| | NR_TDD_FR2_F | | | | | | TBD | TBD |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | NR_TDD_FR2_G | | | | | | TBD | TBD |
| | NR_TDD_FR2_T | | | | | | TBD | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| Io[Note2] | NR_TDD_FR2_A | dBm/95.04 MHz [Note4] | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 2: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 3: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.<br>Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone<br>Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone<br>Note 6: NR operating band groups are as defined in Section 3.5.2. | | | | | | | | |

#### A.7.7.2.1.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in section 10.1.8.1.1.

### A.7.7.2.2 SA Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

#### A.7.7.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.9.1.1 and 10.1.9.1.2 for inter-frequency measurement.

#### A.7.7.2.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 alnd Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in Table A.7.7.2.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test parameters in Table A.7.7.2.2.2-2 and Table A.7.7.2.2.2-3.. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

**Table A.5.7.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations**

| Configuration | Description |
|---|---|
| 1 | 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |

**Table A.5.7.2.2.2-2: SS-RSRQ Inter frequency general test parameters**

| Parameter | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|
| | | Cell 1 | Cell 2 | Cell 1 | Cell 2 | Cell 1 | Cell 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SSB ARFCN | | freq1 | freq2 | freq1 | freq2 | freq1 | freq2 |
| Duplex mode | | TDD | | TDD | | TDD | |
| TDD configuration | | TDDConf.3.1 | | TDDConf.3.1 | | TDDConf.3.1 | |
| $BW_{channel}$ | MHz | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | | 100: $N_{RB,c}$ = 66 | |
| PDSCH Reference measurement channel | | SR.3.1 TDD | - | SR.3.1 TDD | - | SR.3.1 TDD | - |
| RMSI CORESET Reference Channel | | CR.3.1 TDD | - | CR.3.1 TDD | - | CR.3.1 TDD | - |
| OCNG Patterns | | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 | OP.1 |
| SMTC configuration | | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 | SMTC.1 FR2 |
| PDSCH/PDCCH subcarrier spacing | kHz | 120 | 120 | 120 | 120 | 120 | 120 |
| EPRE ratio of PSS to SSS<br>EPRE ratio of PBCH_DMRS to SSS<br>EPRE ratio of PBCH to PBCH_DMRS<br>EPRE ratio of PDCCH_DMRS to SSS<br>EPRE ratio of PDCCH to PDCCH_DMRS<br>EPRE ratio of PDSCH_DMRS to SSS<br>EPRE ratio of PDSCH to PDSCH_DMRS<br>EPRE ratio of OCNG DMRS to SSS[Note 1] | dB | 0 | 0 | 0 | 0 | 0 | 0 |
| $\hat{E}_s / N_{oc}$ | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled.<br>Note 3: SS-RSRQ, SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 4: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | | | |

**Table A.5.7.2.2.2-3: SS-RSRQ Inter frequency OTA related test parameters**

| Parameter | | Unit | Test 1 | | Test 2 | | Test 3 | |
|---|---|---|---|---|---|---|---|---|
| | | | Cell 1 | Cell 2 | Cell 1 | Cell 2 | Cell 1 | Cell 2 |
| UE orientation around TBD axis and TBD axis | | degrees | TBD | | TBD | | TBD | |
| Relative difference in angle of arrival of cell 2 relative to cell 1 | | degrees | NA | TBD | NA | 0 | NA | 0 |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/15kHz Note4 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | dBm/SCS Note 3 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| SS-RSRP Note2 | NR_TDD_FR2_A | dBm/SCS Note4 | TBD | TBD | TBD | TBD | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD | TBD |
| | NR_TDD_FR2_F | | | | | | TBD | TBD |
| | NR_TDD_FR2_G | | | | | | TBD | TBD |
| | NR_TDD_FR2_T | | | | | | TBD | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD | TBD |
| SS-RSRQ Note2 | NR_TDD_FR2_A | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| | NR_TDD_FR2_B | | | | | | TBD | TBD |
| | NR_TDD_FR2_F | | | | | | TBD | TBD |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | NR_TDD_FR2_G | | | | | | TBD | TBD |
| | NR_TDD_FR2_T | | | | | | TBD | TBD |
| | NR_TDD_FR2_Y | | | | | | TBD | TBD |
| $\hat{E}_s/I_{ot}$ | | dB | TBD | TBD | TBD | TBD | TBD | TBD |
| Io Note2 | NR_TDD_FR2_A | dBm/95.04 MHz Note4 | TBD | | TBD | | TBD | |
| | NR_TDD_FR2_B | | | | | | TBD | |
| | NR_TDD_FR2_F | | | | | | TBD | |
| | NR_TDD_FR2_G | | | | | | TBD | |
| | NR_TDD_FR2_T | | | | | | TBD | |
| | NR_TDD_FR2_Y | | | | | | TBD | |
| Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. | | | | | | | | |
| Note 2: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. | | | | | | | | |
| Note 3: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | | | | |
| Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone | | | | | | | | |
| Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone | | | | | | | | |
| Note 6: NR operating band groups are as defined in Section 3.5.2. | | | | | | | | |

##### A.7.7.2.2.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in section 10.1.9.1.1 and 10.1.9.1.2.

### A.7.7.3 SS-SINR

### A.7.7.4 L1-RSRP measurement for beam reporting

#### A.7.7.4.1 SSB based L1-RSRP measurement

##### A.7.7.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 9.5.2 and section 10.1.20.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in Table A.7.7.4.1.1-1.

The AoA setup for this test is TBD.

**Table A.7.7.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test**

| Config | Description |
|---|---|
| 1 | LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| 2 | LTE FDD, NR 240 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

##### A.7.7.4.1.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.7.7.4.1.2-1 and Table A.7.7.4.1.2-2 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in Table A.7.7.4.1.2-1 and Table A.7.7.4.1.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0 and 1. The TCI status for Cell 2 is defined in Table [TBD] and TRS configuration for Cell 2 is defined in Table [TBD].

**Table A.7.7.4.1.2-1: FR2 SSB based L1-RSRP general test parameters**

| Parameter | Config | Unit | Test 1 | Test 2 |
|---|---|---|---|---|
| SSB GSCN | 1~2 | | freq1 | freq1 |
| Duplex mode | 1~2 | | TDD | TDD |
| TDD Configuration | 1~2 | | TDDConf.3.1 | TDDConf.3.1 |
| $BW_{channel}$ | 1~2 | MHz | 100: $N_{RB,c}$ = 66 | 100: $N_{RB,c}$ = 66 |
| PDSCH Reference measurement channel | 1~2 | | SR.3.1 TDD | SR.3.1 TDD |
| RMSI CORESET Reference Channel | 1~2 | | CR.3.1 TDD | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | 1~2 | | CCR.3.1 TDD | CCR.3.1 TDD |
| SSB configuration | 1 | | SSB.1 FR2 | SSB.1 FR2 |
| | 2 | | SSB.2 FR2 | SSB.2 FR2 |
| OCNG Patterns | 1~2 | | OP.1 | OP.1 |
| DL BWP | 1~2 | | DLBWP.1.1 | DLBWP.1.1 |
| UL BWP | 1~2 | | ULBWP.1.1 | ULBWP.1.1 |
| SMTC configuration | 1~2 | | SMTC.1 | SMTC.1 |
| Number of reported RS | 1~2 | | 2 | 2 |
| L1-RSRP reporting period | 1~2 | | TBD | TBD |
| Propagation condition | 1~2 | | AWGN | AWGN |
| EPRE ratio of PSS to SSS | 1~2 | dB | 0 | 0 |
| EPRE ratio of PBCH DMRS to SSS | | | | |
| EPRE ratio of PBCH to PBCH DMRS | | | | |
| EPRE ratio of PDCCH DMRS to SSS | | | | |
| EPRE ratio of PDCCH to PDCCH DMRS | | | | |
| EPRE ratio of PDSCH DMRS to SSS | | | | |
| EPRE ratio of PDSCH to PDSCH DMRS | | | | |
| EPRE ratio of OCNG DMRS to SSS Note 1 | | | | |
| EPRE ratio of OCNG to OCNG DMRS Note 1 | | | | |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. | | | | |

**Table A.7.7.4.1.2-2: FR2 SSB based L1-RSRP OTA related test parameters**

| Parameter | | Config | Unit | Test 1 | Test 2 |
|---|---|---|---|---|---|
| $N_{oc}$ Note1 | NR_TDD_FR2_A | 1~2 | dBm/15kHz | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| $N_{oc}$ Note1 | NR_TDD_FR2_A | 1 | dBm/SSB SCS | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| | NR_TDD_FR2_A | 2 | | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |

| | | | | | |
|---|---|---|---|---|---|
| $\hat{E}_s/I_{ot}$ | | 1~2 | dB | TBD | TBD |
| SSB RSRP Note1 | NR_TDD_FR2_A | 1 | dBm/SSB SCS | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| | NR_TDD_FR2_A | 2 | | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| Io Note1 | NR_TDD_FR2_A | 1 | dBm/95.04MHz | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| | NR_TDD_FR2_A | 2 | | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| $\hat{E}_s/N_{oc}$ | | 1~2 | dB | TBD | TBD |
| Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | |

#### A.7.7.4.1.3 Test Requirements

The L1-RSRP measurement accuracy for SSB#0 and SSB#1 of Cell 1 shall fulfil the requirements in sections 10.1.20.1.

Editor's Note: which reports are used to verify the accuracy is FFS

### A.7.7.4.2 CSI-RS based L1-RSRP measurement

#### A.7.7.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Sections 9.5.3 and section 10.1.20.2 for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in Table A.7.7.4.2.1-1.

The AoA setup for this test is TBD.

**Table A.7.7.4.2.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test**

| Config | Description |
|---|---|
| 1 | NR 120 kHz CSI-RS SCS, 100MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations | |

#### A.7.7.4.2.2 Test parameters

In this set of test cases there are one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.7.7.4.2.2-1 and Table A.7.7.4.2.2-2 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in Table A.7.7.4.2.2-1 and Table A.7.7.4.2.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform L1-RSRP measurement based on the CSI-RS resources 0 and 1. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as

SSB. Repetition is configured as TBD for the CSI-RS resource set. The TCI status for Cell 2 is defined in Table [TBD] and TRS configuration for Cell 2 is defined in Table [TBD].

### Table A.7.7.4.2.2-1: FR2 CSI-RS based L1-RSRP general test parameters

| Parameter | Config | Unit | Test 1 | Test 2 |
|---|---|---|---|---|
| SSB GSCN | 1 | | freq1 | freq1 |
| Duplex mode | 1 | | TDD | TDD |
| TDD Configuration | 1 | | TDDConf.3.1 | TDDConf.3.1 |
| $BW_{channel}$ | 1 | MHz | 100: $N_{RB,c}$ = 66 | 100: $N_{RB,c}$ = 66 |
| PDSCH Reference measurement channel | 1 | | SR.3.1 TDD | SR.3.1 TDD |
| RMSI CORESET Reference Channel | 1 | | CR.3.1 TDD | CR.3.1 TDD |
| Dedicated CORESET Reference Channel | 1 | | CCR.3.1 TDD | CCR.3.1 TDD |
| SSB configuration | 1 | | SSB.1 FR2 | SSB.1 FR2 |
| OCNG Patterns | 1 | | OP.1 | OP.1 |
| DL BWP | 1 | | DLBWP.1.1 | DLBWP.1.1 |
| UL BWP | 1 | | ULBWP.1.1 | ULBWP.1.1 |
| SMTC configuration | 1 | | SMTC.1 | SMTC.1 |
| CSI-RS 0 | 1 | | CSI-RS.3.2 TDD | CSI-RS.3.2 TDD |
| CSI-RS 1 | 1 | | CSI-RS.3.3 TDD | CSI-RS.3.3 TDD |
| Number of reported RS | 1 | | 2 | 2 |
| Propagation condition | 1 | | AWGN | AWGN |
| EPRE ratio of PSS to SSS<br>EPRE ratio of PBCH DMRS to SSS<br>EPRE ratio of PBCH to PBCH DMRS<br>EPRE ratio of PDCCH DMRS to SSS<br>EPRE ratio of PDCCH to PDCCH DMRS<br>EPRE ratio of PDSCH DMRS to SSS<br>EPRE ratio of PDSCH to PDSCH DMRS<br>EPRE ratio of OCNG DMRS to SSS Note 1<br>EPRE ratio of OCNG to OCNG DMRS Note 1 | 1 | dB | 0 | 0 |
| Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.<br>Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for $N_{oc}$ to be fulfilled. | | | | |

### Table A.7.7.4.2.2-2: FR2 CSI-RS based L1-RSRP OTA related test parameters

| Parameter | | Config | Unit | Test 1 | Test 2 |
|---|---|---|---|---|---|
| $N_{oc}$ Note2 | NR_TDD_FR2_A | 1 | dBm/15kHz | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| $N_{oc}$ Note2 | NR_TDD_FR2_A | 1 | dBm/CSI-RS SCS | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| $\hat{E}_s/I_{ot}$ | | 1 | dB | TBD | TBD |
| CSI-RS RSRP Note3 | NR_TDD_FR2_A | 1 | dBm/CSI-RS SCS | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |

| | | | | | |
|---|---|---|---|---|---|
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| Io Note3 | NR_TDD_FR2_A | 1 | dBm/95.04MHz | TBD | TBD |
| | NR_TDD_FR2_B | | | | TBD |
| | NR_TDD_FR2_F | | | | TBD |
| | NR_TDD_FR2_G | | | | TBD |
| | NR_TDD_FR2_T | | | | TBD |
| | NR_TDD_FR2_Y | | | | TBD |
| $\hat{E}_s/N_{oc}$ | | 1 | dB | TBD | TBD |
| Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.<br>Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. | | | | | |

### A.7.7.4.2.3 Test Requirements

The L1-RSRP measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 1 shall fulfil the requirements in sections 10.1.20.2.

Editor's Note: which reports are used to verify the accuracy is FFS

# A.8 E-UTRA standalone tests for NR RRM

*Editor notes: All NR RRM tests under E-UTRA standalone operations are included in this Annex. All EN-DC related NR RRM tests are in A.6*

# Annex B (normative): Conditions for RRM requirements applicability for operating bands

# B.1 Conditions for NR RRC_IDLE state mobility

## B.1.1 Introduction

In Annex B.1, the following conditions are specified:

- UE conditions which shall apply for UE intra-frequency measurements procedures and requirements in Section 4,
- UE conditions which shall apply for UE inter-frequency measurements procedures and requirements in Section 4.

## B.1.2 Conditions for measurements on NR intra-frequency cells for cell re-selection

This section defines the following conditions for NR intra-frequency measurements performed based on SSBs for cell re-selection: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in Table B.1.2-1 for FR1 NR cells.

The conditions are defined in Table B.1.2-2 for FR2 NR cells.

**Table B.1.2-1: Conditions for intra-frequency cell re-selection in FR1**

| Parameter | NR operating band groups Note1 | Minimum SSB_RP dBm / $SCS_{SSB}$ | | SSB Ês/Iot |
|---|---|---|---|---|
| | | $SCS_{SSB}$ = 15 kHz | $SCS_{SSB}$ = 30 kHz | dB |
| Conditions | NR_FDD_FR1_A, NR_TDD_FR1_A | -124 | -121 | ≥ -4 |
| | NR_FDD_FR1_B | -123.5 | -120.5 | |
| | NR_TDD_FR1_C | -123 | -120 | |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | -122.5 | -119.5 | |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | -122 | -119 | |
| | NR_FDD_FR1_G | -121 | -118 | |
| | NR_FDD_FR1_H | -120.5 | -117.5 | |
| NOTE 1: NR operating band groups are defined in Section 3.5.2. | | | | |

**Table B.1.2-2: Conditions for intra-frequency cell re-selection in FR2**

| Parameter | NR operating band groups Note1 | Minimum SSB_RP dBm / $SCS_{SSB}$ | | SSB Ês/Iot |
|---|---|---|---|---|
| | | $SCS_{SSB}$ = 120 kHz | $SCS_{SSB}$ = 240 kHz | dB |
| Conditions | NR_TDD_FR2_A | TBD | TBD | TBD |
| | NR_TDD_FR2_B | TBD | TBD | |
| | NR_TDD_FR2_F | TBD | TBD | |
| | NR_TDD_FR2_G | TBD | TBD | |
| | NR_TDD_FR2_T | TBD | TBD | |
| | NR_TDD_FR2_Y | TBD | TBD | |
| NOTE 1: NR operating band groups are defined in Section 3.5.3. | | | | |

### B.1.3 Conditions for measurements on NR inter-frequency cells for cell re-selection

This section defines the following conditions for NR inter-frequency measurements performed based on SSBs for cell re-selection: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions defined in Table B.1.2-1 for FR1 NR intra-frequency cell re-selection shall also apply for FR1 NR inter-frequency cells in this section.

The conditions defined in Table B.1.2-2 for FR2 NR intra-frequency cell re-selection shall also apply for FR2 NR inter-frequency cells in this section.

## B.2 Conditions for UE measurements procedures and performance requirements in RRC_CONNECTED state

### B.2.1 Introduction

In Annex B.2, the following conditions are specified:

- UE conditions which shall apply for UE intra-frequency measurements procedures and requirements in Section 9,

  UE conditions which shall apply for UE inter-frequency measurements procedures and requirements in Section 9,

- UE conditions which shall apply for UE intra-frequency measurements performance requirements in Section 10,
- UE conditions which shall apply for UE inter-frequency measurements performance requirements in Section 10.

### B.2.2 Conditions for NR intra-frequency measurements

This section defines the following conditions for NR intra-frequency measurements and corresponding procedures performed based on SSBs: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in Table B.2.2-1 for FR1 NR cells.

The conditions are defined in Table B.2.2-2 for FR2 NR cells.

**Table B.2.2-1: Conditions for intra-frequency measurements in FR1**

| Parameter | NR operating band groups Note1 | Minimum SSB_RP dBm / $SCS_{SSB}$ | | SSB Ês/Iot |
|---|---|---|---|---|
| | | $SCS_{SSB}$ = 15 kHz | $SCS_{SSB}$ = 30 kHz | dB |
| Conditions | NR_FDD_FR1_A, NR_TDD_FR1_A | -127 | -124 | ≥ -6 |
| | NR_FDD_FR1_B | -126.5 | -123.5 | |
| | NR_TDD_FR1_C | -126 | -123 | |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | -125.5 | -122.5 | |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | -125 | -122 | |
| | NR_FDD_FR1_G | -124 | -121 | |
| | NR_FDD_FR1_H | -123.5 | -120.5 | |
| NOTE 1: NR operating band groups are defined in Section 3.5.2. | | | | |

**Table B.2.2-2: Conditions for intra-frequency measurements in FR2**

| Parameter | NR operating band groups Note1 | Minimum SSB_RP | | SSB Ês/Iot |
|---|---|---|---|---|
| | | dBm / $SCS_{SSB}$ | | dB |
| | | $SCS_{SSB}$ = 120 kHz | $SCS_{SSB}$ = 240 kHz | |
| Conditions | NR_TDD_FR2_A | TBD | TBD | TBD |
| | NR_TDD_FR2_B | TBD | TBD | |
| | NR_TDD_FR2_F | TBD | TBD | |
| | NR_TDD_FR2_G | TBD | TBD | |
| | NR_TDD_FR2_T | TBD | TBD | |
| | NR_TDD_FR2_Y | TBD | TBD | |
| NOTE 1: NR operating band groups are defined in Section 3.5.3. | | | | |

## B.2.3 Conditions for NR inter-frequency measurements

This section defines the following conditions for NR inter-frequency measurements and corresponding procedures performed based on SSBs: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in Table B.2.3-1 for FR1 NR cells.

The conditions are defined in Table B.2.3-2 for FR2 NR cells.

**Table B.2.3-1: Conditions for inter-frequency measurements in FR1**

| Parameter | NR operating band groups Note1 | Minimum SSB_RP | | SSB Ês/Iot |
|---|---|---|---|---|
| | | dBm / $SCS_{SSB}$ | | dB |
| | | $SCS_{SSB}$ = 15 kHz | $SCS_{SSB}$ = 30 kHz | |
| Conditions | NR_FDD_FR1_A, NR_TDD_FR1_A | -125 | -122 | ≥ -4 |
| | NR_FDD_FR1_B | -124.5 | -121.5 | |
| | NR_TDD_FR1_C | -124 | -121 | |
| | NR_FDD_FR1_D, NR_TDD_FR1_D | -124.5 | -120.5 | |
| | NR_FDD_FR1_E, NR_TDD_FR1_E | -123 | -120 | |
| | NR_FDD_FR1_G | -122 | -119 | |
| | NR_FDD_FR1_H | -121.5 | -118.5 | |
| NOTE 1: NR operating band groups are defined in Section 3.5.2. | | | | |

**Table B.2.3-2: Conditions for inter-frequency measurements in FR2**

| Parameter | NR operating band groups Note1 | Minimum SSB_RP | | SSB Ês/Iot |
|---|---|---|---|---|
| | | dBm / $SCS_{SSB}$ | | dB |
| | | $SCS_{SSB}$ = 120 kHz | $SCS_{SSB}$ = 240 kHz | |
| Conditions | NR_TDD_FR2_A | TBD | TBD | TBD |
| | NR_TDD_FR2_B | TBD | TBD | |
| | NR_TDD_FR2_F | TBD | TBD | |
| | NR_TDD_FR2_G | TBD | TBD | |
| | NR_TDD_FR2_T | TBD | TBD | |
| | NR_TDD_FR2_Y | TBD | TBD | |
| NOTE 1: NR operating band groups are defined in Section 3.5.3. | | | | |

# B.3 RRM Requirements Exceptions

## B.3.1 Introduction

Annex B.3 covers exceptions for side conditions based on receiver sensitivity for CA, DC, and SUL.

# B.3.2 Receiver sensitivity relaxation for CA

## B.3.2.1 Receiver sensitivity relaxation for UE supporting CA in FR1

For a UE supporting inter-band carrier aggregation configuration with uplink in NR band, if there is a relaxation of receiver sensitivity $\Delta R_{IB,c}$>0 dB as defined in TS 38.101-1 [18, Section 7.3A.3], the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB,c}$ defined for the corresponding downlink NR bands.

For a UE supporting CA configuration in FR1, the requirement in this section applies for both SC and CA operation.

## B.3.2.2 Receiver sensitivity relaxation for UE configured with CA in FR1

### B.3.2.2.1 Inter-band carrier aggregation

For a UE configured with inter-band carrier aggregation with active uplink in NR band, if there is a relaxation of receiver sensitivity $\Delta R_{IB,c}$>0 dB as defined in TS 38.101-1 [18, Section 7.3A.3], the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB,c}$ defined for the corresponding downlink NR bands.

If the relaxation Δ specified in this section applies, then the relaxation specified in Section B.3.2.1 should not be applied.

### B.3.2.2.2 Reference sensitivity exceptions due to UL harmonic interference for CA

In this section, requirements exceptions are described for the UE configured with a band in FR1 when it is impacted by UL harmonic interference from another band in FR1 of the same CA configuration.

A relevant side condition (SSB_RP and Io) in a requirement shall be increased by the amount Δ=L2-L1, where L1 is the reference sensitivity level specified in TS 38.101-1 [18, Section 7.3.2], and L2 is the reference sensitivity level based on the requirements in TS 38.101-1 [18, Section 7.3A.4], when the following conditions are fulfilled,

- corresponding downlink component carriers on different NR bands are configured with CA and active,
- the upling is configured in the NR low operating band and is active,
- the uplink configuration is as specified in TS 38.101-1 [18, Section 7.3A.4], and
- the exception requirements specified in TS 38.101-1 [18, Section 7.3A.4] apply.

If the relaxation Δ specified in this section applies, then the relaxation specified in Section B.3.2.1 should not be applied.

### B.3.2.2.3 Reference sensitivity exceptions due to intermodulation interference due to 2UL CA

In this section, requirements exceptions are described for the UE with an inter-band carrier aggregation with uplink assigned to two NR bands.

A relevant side condition (SSB_RP and Io) in a requirement shall be increased by the amount Δ=L2-L1, where L1 is the reference sensitivity level specified in TS 38.101-1 [18, Section 7.3.2], and L2 is the reference sensitivity level based on the requirements in TS 38.101-1 [18, Section 7.3A.5], when the following conditions are fulfilled,

- corresponding downlink component carriers on different bands are configured with CA and active,
- uplinks are assigned to two NR bands,
- the exception requirements specified in TS 38.101-1 [18, Section 7.3A.5] apply.

If the relaxation Δ specified in this section applies, then the relaxation specified in Section B.3.2.1 should not be applied.

### B.3.2.3 Receiver sensitivity relaxation for UE supporting CA in FR2

*Editor's note: TBD*

### B.3.2.4 Receiver sensitivity relaxation for UE configured with CA in FR2

#### B.3.2.4.1 Intra-band contiguous carrier aggregation

For a UE configured with intra-band contiguous carrier aggregation in NR band in FR2, if there is a relaxation of receiver sensitivity $\Delta R_{IB}$>0 dB as defined in TS 38.101-2 [19, Section 7.3A.2.1] depending on the aggregated channel bandwidth, the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB}$ defined for the corresponding downlink NR bands.

#### B.3.2.4.2 Intra-band non-contiguous carrier aggregation

For a UE configured with intra-band non-contiguous carrier aggregation in NR band in FR2, if there is a relaxation of receiver sensitivity $\Delta R_{IB}$>0 dB as defined in TS 38.101-2 [19, Section 7.3A.2.1] depending on the aggregated channel bandwidth, the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB}$ defined for the corresponding downlink NR bands.

## B.3.3 Receiver sensitivity relaxation for DC

Editor's note: TBD

## B.3.4 Receiver sensitivity relaxation for SUL

### B.3.4.1 Receiver sensitivity relaxation for UE supporting SUL in FR1

For a UE supporting a SUL configuration in FR1, if there is a relaxation of receiver sensitivity $\Delta R_{IB,c}$>0 dB as defined in TS 38.101-1 [18, Section 7.3C.3], the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB,c}$ defined for the corresponding downlink NR bands.

For a UE supporting a SUL configuration in FR1, the requirement in this section applies for both SC and SUL operation.

### B.3.4.2 Receiver sensitivity relaxation for UE configured with SUL in FR1

#### B.3.4.2.1 Reference sensitivity exceptions due to UL harmonic interference for SUL

In this section, requirements exceptions are described for the UE with a band in FR1 when it is impacted by UL harmonic interference from another band in FR1 of the same SUL configuration.

A relevant side condition (SSB_RP and Io) in a requirement shall be increased by the amount $\Delta$=L2-L1, where L1 is the reference sensitivity level specified in TS 38.101-1 [18, Section 7.3.2], and L2 is the reference sensitivity level based on the requirements in TS 38.101-1 [18, Section 7.3C.2], when the following conditions are fulfilled,

- a downlink component carrier is configured in NR band and is active,
- the upling is configured in the NR low operating band and is active,
- the uplink configuration is as specified in TS 38.101-1 [18, Section 7.3C.2], and
- the exception requirements specified in TS 38.101-1 [18, Section 7.3C.2] apply.

If the relaxation $\Delta$ specified in this section applies, then the relaxation specified in Section B.3.4.1 should not be applied.

# Annex C (informative): Change history

| Change history | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2017-05 | RAN4#83 | R4-1706324 | | | | Specification skeleton | 0.0.1 |
| 2017-09 | | | | | | Email approved | 0.1.0 |
| 2017-09 | RAN4-NR AH #3 | R4-1709413 | | | | Capture TPs approved in the meeting | 0.2.0 |
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| 2017-12 | RAN4#85 | R4-1714546 | | | | Capture TPs approved in RAN4#85 | 0.4.0 |
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| 2018-06 | RAN#80 | RP-181075 | 0037 | | B | CR to TS 38.133: Implementation of endorsed draft CRs from RAN4 #86bis and RAN4 #87 | 15.2.0 |
| 2018-09 | RAN#81 | RP-181896 | 0043 | | B | CR to TS 38.133: Implementation of endorsed draft CRs from RAN4-AH-1807 and RAN4 #88 | 15.3.0 |
| 2018-12 | RAN#82 | RP-182763 | 0057 | 3 | B | CR to TS 38.133: Implementation of endorsed draft CRs from RAN4-88bis and RAN4-89 | 15.4.0 |

# History

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