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TECHNICAL SPECIFICATION

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Evolved Universal Terrestrial Radio Access (E-UTRA);
User Equipment (UE) procedures in idle mode
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Contents

Foreword

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1 Scope

The present document specifies the Access Stratum (AS) part of the Idle Mode procedures applicable to a UE. The non-access stratum (NAS) part of Idle mode procedures and processes is specified in TS 23.122 [5].

The present document specifies the model for the functional division between the NAS and AS in a UE.

The present document applies to all UEs that support at least E-UTRA, including multi-RAT UEs as described in 3GPP specifications, in the following cases:

- When the UE is camped on an E-UTRA cell;

- When the UE is searching for a cell to camp on;

NOTE: When the UE is camped on or searching for a cell to camp on belonging to other RATs, the UE behaviour is described in the specifications of the other RAT.

The Idle Mode procedures defined in this specification are also applicable for a UE in RRC_INACTIVE state unless specified otherwise.

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 TR 25.990: "Vocabulary for UTRAN".

[2]   3GPP TS 36.300: "E-UTRA and E-UTRAN Overall Description; Stage 2".

[3]   3GPP TS 36.331: "E-UTRA; Radio Resource Control (RRC) - Protocol Specification".

[4]   3GPP TS 22.011: "Service accessibility".

[5]   3GPP TS 23.122: "NAS functions related to Mobile Station (MS) in idle mode".

[6]   3GPP TS 36.213: "E-UTRA; Physical layer procedures".

[7]   3GPP TS 36.214: "E-UTRA; Physical layer; Measurements".

[8]   3GPP TS 25.304: "User Equipment (UE) procedures in idle mode and procedures for cell reselection in connected mode"

[9]   3GPP TS 43.022: "Functions related to Mobile Station in idle mode and group receive mode".

[10]   3GPP TS 36.133: "Requirements for Support of Radio Resource Management".

[11]   void

[12]   void

[13]   void

[14]   void

[15]   void

[16]   3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3"

[17]   3GPP2 C.S0024-C v2.0: "cdma2000 High Rate Packet Data Air Interface Specification".

[18]   3GPP2 C.S0005-F v1.0: "Upper Layer (Layer 3) Signalling Standard for cdma2000 Spread Spectrum Systems".

[19]   3GPP TS 25.304: "User Equipment (UE) procedures in idle mode and procedures for cell reselection in connected mode".

[20]   3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols; Stage 3"

[21]   3GPP TS 37.320: "Universal Terrestrial Radio Access (UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRA); Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; Stage 2".

[22]   3GPP TS 26.346: "Multimedia Broadcast/Multicast Service (MBMS); Protocols and codecs".

[23]   3GPP TS 23.401: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access".

[24]   3GPP TS 23.682: "Architecture enhancements to facilitate communications with packet data networks and applications".

[25]   3GPP TS 23.402: "Architecture enhancements for non-3GPP accesses".

[26]   IEEE 802.11, Part 11: "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications, IEEE Std.".

[27]   Wi-Fi Alliance Technical Committee, Hotspot 2.0 Technical Task Group: "Hotspot 2.0 (Release 2) Technical Specification".

[28]   3GPP TS 24.302: "Access to the 3GPP Evolved Packet Core (EPC) via non-3GPP access networks".

[29]   3GPP TS 23.303: "Proximity-based services (ProSe); Stage 2".

[30]   3GPP TS 36.321: "E-UTRA; Medium Access Control (MAC) protocol specification".

[31]   3GPP TS 24.105: "Application specific Congestion control for Data Communication (ACDC) Management Object (MO)".

[32]   3GPP TS 31.102: "Characteristics of the Universal Subscriber Identity Module (USIM) application".

[33]   3GPP TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception".

[34]   Void

[35]   3GPP TS 23.003: "Numbering, addressing and identification".

[36]   3GPP TS 23.285: "Technical Specification Group Services and System Aspects; Architecture enhancements for V2X services".

[37]   3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[38]   3GPP TS 38.304: "New Generation Radio Access Network; User Equipment (UE) procedures in Idle mode and RRC Inactive state".

[39]   3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[40]   3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services".

3   Definitions and abbreviations

3.1   Definitions

For the purposes of the present document, the following terms and definitions apply:

Acceptable Cell: A cell that satisfies certain conditions as specified in 4.3. A UE can always attempt emergency calls on an acceptable cell, but restriction as in 5.3.3 apply.

Alternative cell reselection priority: Cell reselection priority broadcast in the system information via *altCellReselectionPriority* and *altCellReselectionSubPriority*.

CSG Whitelist: A list provided by NAS containing all the CSG identities and their associated PLMN IDs of the CSGs to which the subscriber belongs.

> NOTE: This list is known as Allowed CSG List in Rel-8 Access Stratum specifications.

Available PLMN(s): One or more PLMN(s) for which the UE has found at least one cell and read its PLMN identity(ies).

Barred Cell: A cell a UE is not allowed to camp on.

Camped on a cell: UE has completed the cell selection/reselection process and has chosen a cell. The UE monitors system information and (in most cases) paging information.

Camped on any cell: UE is in idle mode and has completed the cell selection/reselection process and has chosen a cell irrespective of PLMN identity.

Closed Subscriber Group (CSG): A Closed Subscriber Group identifies subscribers of an operator who are permitted to access one or more cells of the PLMN but which have restricted access (CSG cells).

CN type: The type of core network connectivity supported by an E-UTRA cell, either EPC or 5GC.

Commercial Mobile Alert System: Public Warning System that delivers *Warning Notifications* provided by *Warning Notification Providers* to CMAS capable UEs.

CSG cell: A cell broadcasting a CSG indication that is set to TRUE and a specific CSG identity.

CSG identity: An identifier broadcast by a CSG or hybrid cell/cells and used by the UE to facilitate access for authorised members of the associated Closed Subscriber Group.

CSG member cell: a cell broadcasting the identity of the selected PLMN, registered PLMN or equivalent PLMN and for which the CSG whitelist of the UE includes an entry comprising cell's CSG ID and the respective PLMN identity.

DRX cycle: Individual time interval between monitoring Paging Occasion for a specific UE.

eDRX cycle: Time interval between the first Paging Occasions occurring after successive extended DRX periods.

eCall Only Mode: A UE configuration option that allows the UE to attach at EPS and register in IMS to perform only eCall Over IMS, and a non-emergency IMS call for test and/or terminal reconfiguration services.

EHPLMN: Any of the PLMN entries contained in the Equivalent HPLMN list TS 23.122 [5].

Equivalent PLMN list: List of PLMNs considered as equivalent by the UE for cell selection, cell reselection, and handover according to the information provided by the NAS.

EU-Alert: Public Warning System that delivers Warning Notifications provided by Warning Notification Providers using the same AS mechanisms as defined for CMAS.

Home PLMN: A PLMN where the Mobile Country Code (MCC) and Mobile Network Code (MNC) of the PLMN identity are the same as the MCC and MNC of the IMSI.

HNB Name: The Home eNodeB Name is a broadcast string in free text format that provides a human readable name for the Home eNodeB CSG identity and any broadcasted PLMN identity.

HSDN cell: A cell that has higher priority than other cells for cell reselection for HSDN capable UE in a High-mobility state.

Hybrid cell: A cell broadcasting a CSG Indicator that is set to FALSE and a specific CSG identity.

Hyper SFN: Index broadcast in System Information that increments at every SFN wrap around (i.e every 10.24s).

Korean Public Alert System (KPAS): Public Warning System that delivers Warning Notifications provided by Warning Notification Providers using the same AS mechanisms as defined for CMAS.

Location Registration (LR): UE registers its presence in a registration area, for instance regularly or when entering a new tracking area.

MBMS-dedicated cell: cell dedicated to MBMS transmission.

MBMS/Unicast-mixed cell: cell supporting both unicast and MBMS transmissions.

FeMBMS/Unicast-mixed cell: cell supporting MBMS transmission and unicast transmission as SCell.

NB-IoT: NB-IoT allows access to network services via E-UTRA with a channel bandwidth limited to 200 kHz.

NR sidelink communication: AS functionality enabling at least V2X Communication as defined in TS 23.287 [40], between two or more nearby UEs, using NR technology but not traversing any network node.

Paging Time Window: The period configured for a UE in extended DRX, during which the UE monitors Paging Occasions following DRX cycle.

Power saving mode: Mode allowing the UE to reduce its power consumption, as defined in TS 24.301 [16], TS 23.401 [23], TS 23.682 [24].

Process: A local action in the UE invoked by a RRC procedure or an Idle Mode or RRC_INACTIVE state procedure.

Radio Access Technology: Type of technology used for radio access, for instance E-UTRA, UTRA, GSM, CDMA2000 1xEV-DO (HRPD) or CDMA2000 1x (1xRTT).

Registered PLMN: This is the PLMN on which certain Location Registration outcomes have occurred TS 23.122 [5].

Registration Area: (NAS) registration area is an area in which the UE may roam without a need to perform location registration, which is a NAS procedure.

Reserved Cell: A cell on which camping is not allowed, except for particular UEs, if so indicated in the system information.

Restricted Cell: A cell on which camping is allowed, but access attempts are disallowed for UEs whose access classes are indicated as barred.

Selected PLMN: This is the PLMN that has been selected by the NAS, either manually or automatically.

Serving cell: The cell on which the UE is camped.

Sidelink: UE to UE interface for sidelink communication, V2X sidelink communication and sidelink discovery. The Sidelink corresponds to the PC5 interface as defined in TS 23.303 [29].

Sidelink communication: AS functionality enabling ProSe Direct Communication as defined in TS 23.303 [29], between two or more nearby UEs, using E-UTRA technology but not traversing any network node. The terminology "sidelink communication" without "V2X" prefix only concerns PS unless specifically stated otherwise.

Sidelink discovery: AS functionality enabling ProSe Direct Discovery as defined in TS 23.303 [29], using E-UTRA technology but not traversing any network node.

Strongest cell: The cell on a particular carrier that is considered strongest according to the layer 1 cell search procedure TS 36.213 [6], TS 36.214 [7].

Suitable Cell: This is a cell on which an UE may camp. For a E-UTRA cell, the criteria are defined in clause 4.3, for a UTRA cell in TS 25.304 [8], for a GSM cell in TS 43.022 [9], and for a NR cell in TS 38.304 [38].

V2X sidelink communication: AS functionality enabling V2X Communication as defined in TS 23.285 [36], between nearby UEs, using E-UTRA technology but not traversing any network node.

3.2 Symbols

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

    <symbol>   <Explanation>

3.3 Abbreviations

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

1xRTT	CDMA2000 1x Radio Transmission Technology
AS	Access Stratum
AC	Access Class (of the USIM)
ACDC	Application specific Congestion control for Data Communication
BCCH	Broadcast Control Channel
BL	Bandwidth reduced Low complexity
BR-BCCH	Bandwidth Reduced Broadcast Control Channel
BSS	Basic Service Set
CMAS	Commercial Mobile Altert System
CSG	Closed Subscriber Group
DRX	Discontinuous Reception
DL-SCH	Downlink Shared Channel
EHPLMN	Equivalent Home PLMN
EPC	Evolved Packet Core
EPS	Evolved Packet System
ETWS	Earthquake and Tsunami Warning System
E-UTRA	Evolved UMTS Terrestrial Radio Access
E-UTRAN	Evolved UMTS Terrestrial Radio Access Network
FDD	Frequency Division Duplex
GERAN	GSM/EDGE Radio Access Network
GWUS	Group Wake Up Signal
HPLMN	Home PLMN
HSDN	High Speed Dedicated Network
H-SFN	Hyper System Frame Number
HRPD	High Rate Packet Data
IAB	Integrated Access and Backhaul
IMSI	International Mobile Subscriber Identity
MBMS	Multimedia Broadcast-Multicast Service
MBSFN	Multimedia Broadcast multicast service Single Frequency Network
MCC	Mobile Country Code
MCCH	Multicast Control Channel
MDT	Minimization of Drive Tests
MM	Mobility Management
MNC	Mobile Network Code
MPDCCH	MTC Physical Downlink Control Channel
MTCH	Multicast Traffic Channel
NAS	Non-Access Stratum
NB-IoT	NarrowBand Internet of Things
NR	NR Radio Access
NRS	Narrowband Reference Signal
PLMN	Public Land Mobile Network
ProSe	Proximity-based Services
PSM	Power Saving Mode
PTW	Paging Time Window
PWS	Public Warning System
RAT	Radio Access Technology
RNA	RAN-based Notification Area
RNAU	RAN-based Notification Area Update

RRC	Radio Resource Control
SAP	Service Access Point
SIBX	SystemInformationBlockTypeX
TDD	Time Division Duplex
UAC	Unified Access Control
UE	User Equipment
UMTS	Universal Mobile Telecommunications System
USIM	Universal Subscriber Identity Module
UTRA	UMTS Terrestrial Radio Access
UTRAN	UMTS Terrestrial Radio Access Network
V2X	Vehicle-to-Everything
WUS	Wake Up Signal

4 General description of Idle mode

4.1 Overview

The idle mode tasks can be subdivided into four processes:

- PLMN selection;

- Cell selection and reselection;

- Location registration;

- Support for manual CSG selection.

The relationship between these processes is illustrated in Figure 4.1-1.
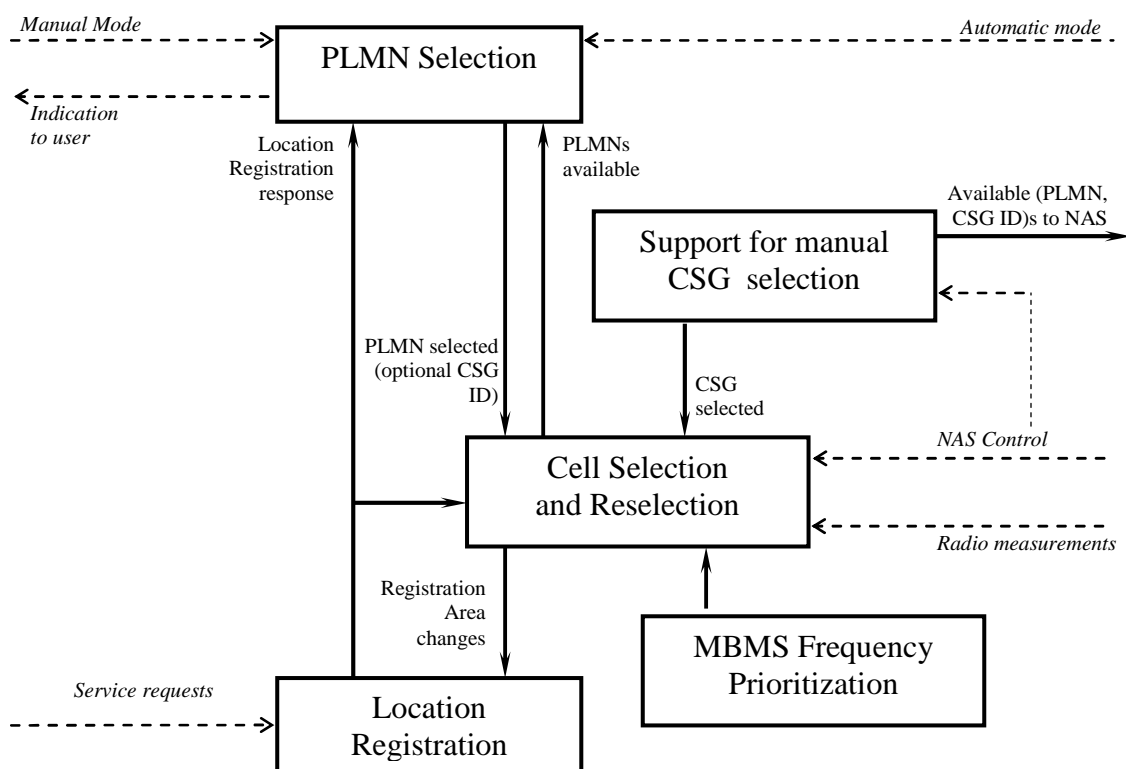
Figure 4.1-1: Overall Idle Mode process

When a UE is switched on, a public land mobile network (PLMN) is selected by NAS. For the selected PLMN, associated RAT(s) may be set TS 23.122 [5]. The NAS shall provide a list of equivalent PLMNs, if available, that the AS shall use for cell selection and cell reselection.

With the cell selection, the UE searches for a suitable cell of the selected PLMN and chooses that cell to provide available services, further the UE shall tune to its control channel. This choosing is known as "camping on the cell".

For E-UTRA a cell may be associated with more than one CN type (EPC and/or 5GC) and hence the selected cell can be suitable for more than one CN type. The CN type(s) for which the selected cell is suitable are reported to NAS which selects a CN type to be used for camping and for the NAS registration procedure (see below). Note that CN type selection is only applicabe for UE supporting E-UTRA connected to 5GC.

The UE shall, if necessary, then register its presence, by means of a NAS registration procedure, in the tracking area of the chosen cell and as outcome of a successful Location Registration the selected PLMN becomes the registered PLMN TS 23.122 [5].

If the UE finds a more suitable cell, according to the cell reselection criteria, it reselects onto that cell and camps on it. Similar to cell selection procedure, if the reselected cell is an E-UTRA cell and the UE supports E-UTRA connected to 5GC, the CN type(s) for which the cell is suitable are reported to NAS which selects one of them. If the new cell does not belong to at least one tracking area to which the UE is registered, location registration is performed. In RRC_INACTIVE state, if the new cell does not belong to the configured RNA, a RNA update procedure is performed.

If necessary, the UE shall search for higher priority PLMNs at regular time intervals as described in TS 22.011 [4] and search for a suitable cell if another PLMN has been selected by NAS.

Search of available CSGs may be triggered by NAS to support manual CSG selection.

If the UE loses coverage of the registered PLMN, either a new PLMN is selected automatically (automatic mode), or an indication of which PLMNs are available is given to the user, so that a manual selection can be made (manual mode).

Registration is not performed by UEs only capable of services that need no registration.

The UE may perform sidelink communication or V2X sidelink communication or sidelink discovery or NR sidelink communication while in-coverage or out-of-coverage for sidelink, as specified in clause 11.

The purpose of camping on a cell in idle mode is fivefold:

   a) It enables the UE to receive system information from the PLMN.

   b) When registered and if the UE wishes to establish an RRC connection, it can do this by initially accessing the network on the control channel of the cell on which it is camped.

   c) If the PLMN receives a call for the registered UE, it knows (in most cases) the set of tracking areas (in RRC_IDLE state) or RNAs (in RRC_INACTIVE state) in which the UE is camped. It can then send a "paging" message for the UE on the control channels of all the cells in this set of tracking areas. The UE will then receive the paging message because it is tuned to the control channel of a cell in one of the registered tracking areas and the UE can respond on that control channel.

   d) It enables the UE to receive ETWS and CMAS notifications.

   e) It enables the UE to receive MBMS services.

If the UE is unable to find a suitable cell to camp on or if the location registration failed (except for LR rejected with cause #12, cause #14, cause #15 or cause #25, see TS 23.122 [5] and TS 24.301 [16]), it attempts to camp on a cell irrespective of the PLMN identity, and enters a "limited service" state.

When NAS indicates that PSM starts, the AS configuration (e.g. priorities provided by dedicated signalling and logged measurements) is kept, all running timers continue to run but the UE need not perform any idle mode tasks. If a timer expires while the UE is in PSM it is up to UE implementation whether it performs the corresponding action immediately or the latest when PSM ends. When NAS indicates that PSM ends, the UE shall perform all idle mode tasks.

4.2 Functional division between AS and NAS in Idle mode

Table 1 presents the functional division between UE non-access stratum (NAS) and UE access stratum (AS) in idle mode. The NAS part is specified in TS 23.122 [5] and the AS part in the present document.

Idle Mode Process	UE Non-Access Stratum	UE Access Stratum
PLMN Selection	Maintain a list of PLMNs in priority order according to TS 23.122 [5]. Select a PLMN using automatic or manual mode as specified in TS 23.122 [5] and request AS to select a cell belonging to this PLMN. For each PLMN, associated RAT(s) may be set. Evaluate reports of available PLMNs and, for E-UTRA if the UEs supports E-UTRA connected to 5GC, CN type(s) from AS for PLMN selection. Maintain a list of equivalent PLMN identities.	Search for available PLMNs. If associated RAT(s) is (are) set for the PLMN, search in this (these) RAT(s) and other RAT(s) for that PLMN as specified in TS 23.122 [5]. Perform measurements to support PLMN selection. Synchronise to a broadcast channel to identify found PLMNs (and CN type(s)). Report available PLMNs with associated RAT(s) and, for E-UTRA if the UE supports E-UTRA connected to 5GC, CN type(s) to NAS on request from NAS or autonomously.
Cell Selection	Control cell selection for example by indicating RAT(s) associated with the selected PLMN to be used initially in the search of a cell in the cell selection. NAS is also maintaining lists of forbidden registration areas and a list of CSG IDs and their associated PLMN ID on which the UE is allowed (CSG whitelist) and provide these lists to AS. NAS may indicate whether the use of coverage enhancements is not authorized for the selected PLMN. NAS may indicate whether the CE mode B is restricted for the UE supporting CE mode B. For E-UTRA if the UE supports E-UTRA connected to 5GC, NAS indicates the CN type to be used for the selected cell.	Perform measurements needed to support cell selection. Detect and synchronise to a broadcast channel. Receive and handle broadcast information. Forward NAS system information to NAS. Search for a suitable cell. The cells broadcast one or more 'PLMN identity' in the system information. Respond to NAS whether such cell is found or not. If associated RATs is (are) set for the PLMN, perform the search in this (these) RAT(s) and other RATs for that PLMN as specified in TS 23.122 [5]. If such a cell is found, the cell is selected to camp on. For E-UTRA if the UE supports E-UTRA connected to 5GC, AS reports the CN type(s) for which the selected cell is suitable to NAS.
Cell Reselection	Control cell reselection by for example, maintaining lists of forbidden registration areas. Maintain a list of equivalent PLMN identities and provide the list to AS. Maintain a list of forbidden registration areas and provide the list to AS. Maintain a list of CSG IDs and their associated PLMN ID on which the UE is allowed (CSG whitelist) to camp and provide the list to AS. For E-UTRA if the UE supports E-UTRA connected to 5GC, NAS indicates the CN type to be used for the selected cell.	Perform measurements needed to support cell reselection. Detect and synchronise to a broadcast channel. Receive and handle broadcast information. Forward NAS system information to NAS. Change cell if a more suitable cell is found. For E-UTRA if the UE supports E-UTRA connected to 5GC, the UE reports the CN type(s) for which the selected cell is suitable to NAS.

Idle Mode Process	UE Non-Access Stratum	UE Access Stratum
Location registration	Register the UE as active after power on. Register the UE's presence in a registration area, for instance regularly or when entering a new tracking area. Maintain lists of forbidden registration areas. Deregister UE when shutting down. Control and restrict location registration for a UE in eCall only mode.	Report registration area information to NAS.
Support for manual CSG selection	Provide request to search for available CSGs. Evaluate reports of available CSGs from AS for CSG selection. Select a CSG and request AS to select a cell belonging to this CSG.	Search for cells with a CSG ID. Read the HNB name from BCCH on SIB9 if a cell with a CSG ID is found. Report CSG ID of the found cell broadcasting a CSG ID together with the HNB name and PLMN(s) to NAS. On selection of a CSG by NAS, select any cell belonging to the selected CSG fulfilling the cell selection criteria and not barred or reserved for operator use for UEs not belonging to AC 11 or 15 and give an indication to NAS that access is possible (for the registration procedure).
RAN Notification Area Update	Not applicable	Register the UE's presence in a RAN-based notification area, periodically or when entering a new RAN-based notification area.

Table 4.2-1: Functional division between AS and NAS in idle mode

4.3 Service types in Idle Mode

This clause defines the level of service that may be provided by the network to a UE in Idle mode.

The action of camping on a cell is necessary to get access to some services. Three levels of services are defined for UE:

- Limited service (emergency calls, ETWS and CMAS on an acceptable cell). It is not applicable to RRC_INACTIVE state.

- Normal service (for public use on a suitable cell)

- Operator service (for operators only on a reserved cell)

Furthermore, the cells are categorised according to which services they offer:

acceptable cell:

An "acceptable cell" is a cell on which the UE may camp to obtain limited service (originate emergency calls and receive ETWS and CMAS notifications), and it is not applicable to RRC_INACTIVE state. Such a cell shall fulfil the following requirements, which is the minimum set of requirements to initiate an emergency call and to receive ETWS and CMAS notification in a E-UTRAN network:

- The cell is not barred, see clause 5.3.1;

- The cell selection criteria are fulfilled, see clause 5.2.3.2;

suitable cell:

A "suitable cell" is a cell on which the UE may camp on to obtain normal service. The UE shall have a valid USIM and such a cell shall fulfil all the following requirements.

- The cell is part of either:

    - the selected PLMN, or:

    - the registered PLMN, or:

    - a PLMN of the Equivalent PLMN list

- For a CSG cell, the cell is a CSG member cell for the UE;

According to the latest information provided by NAS:

- The cell is not barred, see clause 5.3.1;

- The cell is part of at least one TA that is not part of the list of "forbidden tracking areas for roaming" TS 22.011 [4], which belongs to a PLMN that fulfils the first bullet above;

- The cell selection criteria are fulfilled, see clause 5.2.3.2;

- Except for NB-IoT, if the UE supports authorization of coverage enhancements and upper layers indicated that use of coverage enhancements is not authorized for the selected PLMN:

    - the cell selection criterion S in normal coverage shall be fulfilled;

- If the UE supports CE mode B and upper layers indicated that CE mode B is restricted:

    - the cell selection criterion S in normal coverage based on values $Q_{rxlevmin}$ and $Q_{qualmin}$ or in enhanced coverage based on values $Q_{rxlevmin\_CE}$ and $Q_{qualmin\_CE}$ shall be fulfilled.

If more than one PLMN identity is broadcast in the cell, the cell is considered to be part of all TAs with TAIs constructed from the PLMN identities and the TAC broadcast in the cell.

barred cell:

A cell is barred if it is so indicated in the system information TS 36.331 [3].

reserved cell:

A cell is reserved if it is so indicated in system information TS 36.331 [3].

Following exceptions to these definitions are applicable for UEs:

- camped on a cell that belongs to a tracking area that is forbidden for regional provision of service; a cell that belongs to a tracking area that is forbidden for regional provision service (TS 23.122 [5], TS 24.301 [16]) is suitable but provides only limited service.

- as an outcome of the manual CSG selection procedure the UE is allowed to access an acceptable cell which fulfils the cell selection criteria and is not barred or reserved for operator use for UEs not belonging to AC 11 or 15 and inform NAS that access is possible (for location registration procedure).

- NOTE: UE is not required to support manual search and selection of PLMN or CSGs while in RRC CONNECTED state. The UE may use local release of RRC connection to perform manual search if it is not possible to perform the search while RRC connected.

- if a UE has an ongoing emergency call, all acceptable cells of that PLMN are treated as suitable for the duration of the emergency call.

- if the UE in RRC_IDLE fulfils the conditions to support sidelink communication or PS related sidelink discovery in limited service state as specified in TS 23.303 [29], clause 4.5.6, the UE may perform sidelink communication or PS-related sidelink discovery.

- if the UE in RRC_IDLE fulfils the conditions to support V2X sidelink communication or NR sidelink communication in limited service state as specified in TS23.285 [36], clause 4.4.8 and TS 23.287 [40], clause, 5.7, the UE may perform V2X sidelink communication or NR sidelink communication.

For E-UTRA the cell categorization defined above is per CN type. In this specification, when the term suitable/acceptable cell is used without specifying the CN type, it means the cell is suitable/acceptable for any of the CN type(s) supported by the UE.

NOTE: The selected CN Type is not considered during cell selection and reselection procedure.

4.4 NB-IoT functionality in Idle Mode

This specification is applicable to NB-IoT, except for the following functionality which is not applicable to NB-IoT:

- Acceptable cell

- Accessibility measurements

- Access Control based on ACDC categories

- Camped on Any cell state

- CSG, including support for manual CSG selection and CSG or Hybrid cell related functionality in PLMN selection, or HNB name (SIB9), Cell selection and Cell reselection.

- Emergency call

- E-UTRAN Inter-frequency Redistribution procedure

- Inter-RAT Cell Selection and Reselection including measurements in other RATs

- Logged measurements

- Mobility History Information

- Mobility states of a UE

- Priority based reselection

- Public warning system including CMAS, ETWS, PWS.

- RAN-assisted WLAN interworking

- RRC_INACTIVE state

- Sidelink operation

5 Process and procedure descriptions

5.1 PLMN selection

In the UE, the AS shall report available PLMNs to the NAS on request from the NAS or autonomously. For E-UTRA, if UE supports E-UTRA connected to 5GC, the AS shall also report CN type associated with the PLMN to NAS.

During PLMN selection, based on the list of PLMN identities in priority order, the particular PLMN may be selected either automatically or manually. Each PLMN in the list of PLMN identities is identified by a 'PLMN identity'. In the system information on the broadcast channel, the UE can receive one or multiple 'PLMN identity' (and, for E-UTRA, the CN type associated with the PLMN) in a given cell. The result of the PLMN selection performed by NAS (see TS 23.122 [5]) is an identifier of the selected PLMN.

5.1.1 Void

5.1.2 Support for PLMN selection

5.1.2.1 General

On request of the NAS the AS shall perform a search for available PLMNs and report them to NAS.

5.1.2.2 E-UTRA and NB-IoT case

The UE shall scan all RF channels in the E-UTRA bands according to its capabilities to find available PLMNs. On each carrier, the UE shall search for the strongest cell and read its system information, in order to find out which PLMN(s) the cell belongs to. If the UE can read one or several PLMN identities in the strongest cell, each found PLMN (see the PLMN reading in TS 36.331 [3]) shall be reported to the NAS as a high quality PLMN (but without the RSRP value), provided that the following high quality criterion is fulfilled:

1. For an E-UTRAN and NB-IoT cell, the measured RSRP value shall be greater than or equal to -110 dBm.

Found PLMNs that do not satisfy the high quality criterion, but for which the UE has been able to read the PLMN identities are reported to the NAS together with the RSRP value. The quality measure reported by the UE to NAS shall be the same for each PLMN found in one cell.

For each found PLMN, if the UE supports E-UTRA connected to 5GC, the associated CN type(s) shall also be reported to the NAS.

If the cell is barred for connectivity to EPC (as indicated by the *cellBarred*/cellBarred-CRS flag being set to the value barred, see clause 5.3.1) a UE supporting E-UTRA connected to 5GC shall only report the available 5GC PLMNs to NAS.

The search for PLMNs may be stopped on request of the NAS. The UE may optimise PLMN search by using stored information e.g. carrier frequencies and optionally also information on cell parameters from previously received measurement control information elements.

Once the UE has selected a PLMN, the cell selection procedure shall be performed in order to select a suitable cell of that PLMN to camp on.

If a CSG ID is provided by NAS as part of PLMN selection, the UE shall search for an acceptable or suitable cell belonging to the provided CSG ID to camp on. When the UE is no longer camped on a cell with the provided CSG ID, AS shall inform NAS.

5.1.2.3 UTRA case

Support for PLMN selection in UTRA is described in TS 25.304 [8].

5.1.2.4 GSM case

Support for PLMN selection in GERAN is described in TS 43.022 [9].

5.1.2.5 CDMA2000 case

For CDMA2000 the network determination for HRPD and 1xRTT is described in [17] and [18] respectively.

5.1.2.6 NR case

Support for PLMN selection in NR is described in TS 38.304 [38].

5.2 Cell selection and reselection

5.2.1 Introduction

UE shall perform measurements for cell selection and reselection purposes as specified in TS 36.133 [10].

The NAS can control the RAT(s) in which the cell selection should be performed, for instance by indicating RAT(s) associated with the selected PLMN, and by maintaining a list of forbidden registration area(s) and a list of equivalent PLMNs. The UE shall select a suitable cell based on idle mode measurements and cell selection criteria.

In order to speed up the cell selection process, stored information for several RATs may be available in the UE.

When camped on a cell, the UE shall regularly search for a better cell according to the cell reselection criteria. If a better cell is found, that cell is selected. The change of cell may imply a change of RAT, or if the current and selected cell are both E-UTRA cells, a change of the CN type. Details on performance requirements for cell reselection can be found in TS 36.133 [10].

The NAS is informed if the cell selection and reselection results in changes in the received system information relevant for NAS.

For normal service, the UE shall camp on a suitable cell, tune to that cell's control channel(s) so that the UE can:

- Receive system information from the PLMN; and

    - receive registration area information from the PLMN, e.g., tracking area information; and

    - receive other AS and NAS Information; and

- if registered:

    - receive paging and notification messages from the PLMN; and

    - initiate transfer to connected mode.

5.2.2   States and state transitions in Idle Mode

Except for NB-IoT, figure 5.2.2-1 shows the states and state transitions and procedures in RRC_IDLE. Whenever a new PLMN selection is performed, it causes an exit to number 1.
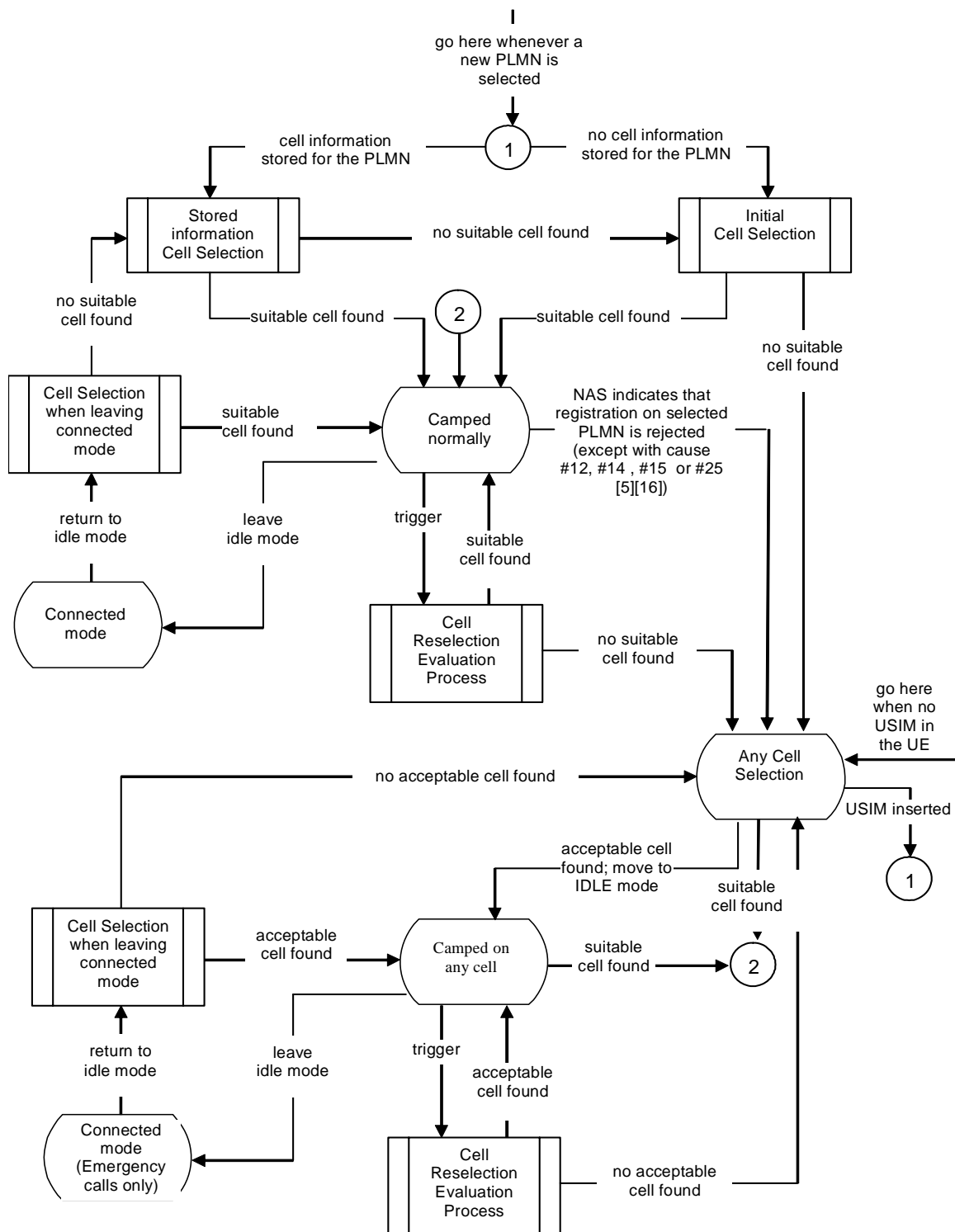
Figure 5.2.2-1: RRC_IDLE Cell Selection and Reselection

For NB-IoT, figure 5.2.2-2 shows the states and state transitions and procedures in RRC_IDLE. Whenever a new PLMN selection is performed, it causes an exit to number 1.
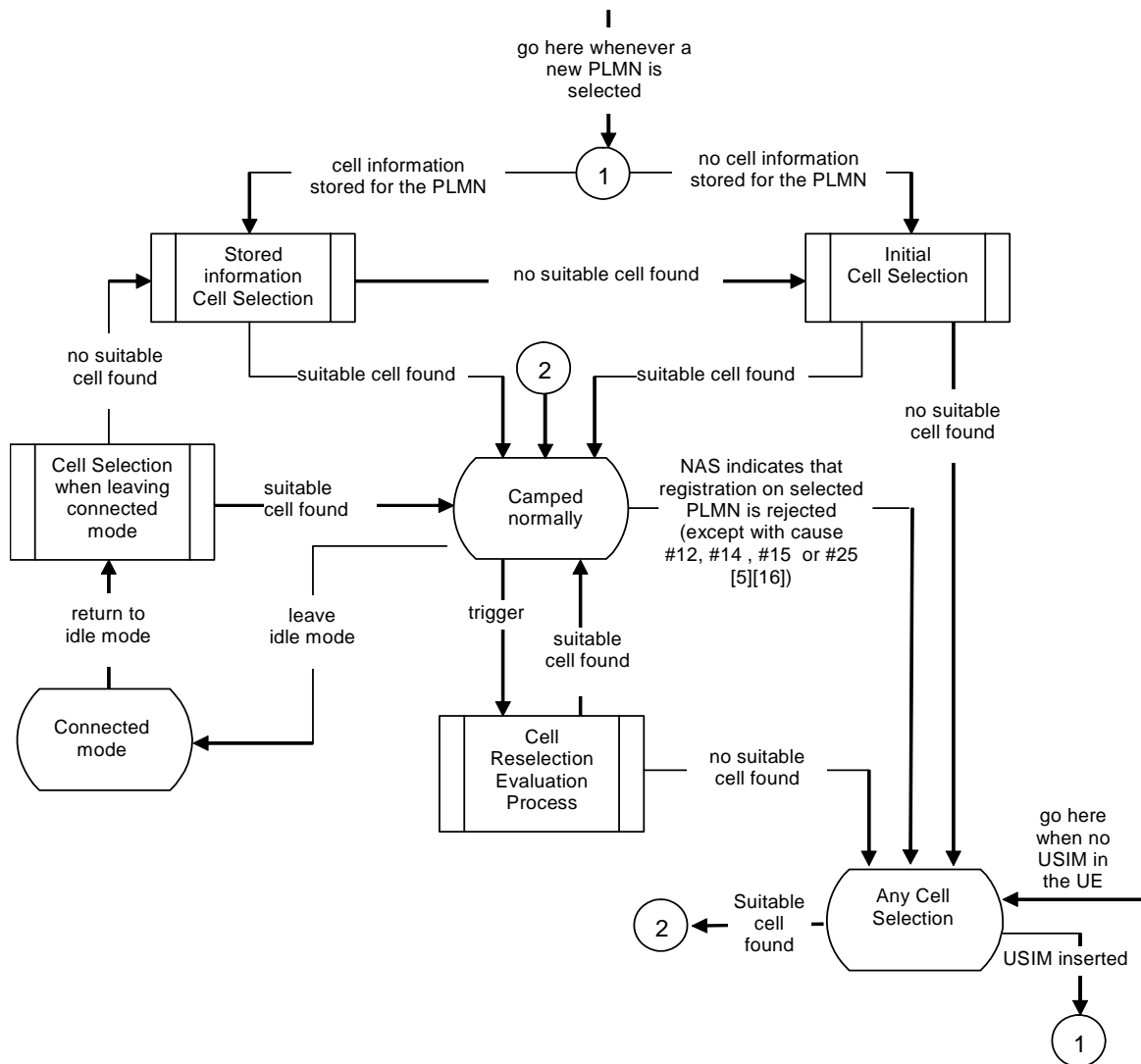
Figure 5.2.2-2: RRC_IDLE Cell Selection and Reselection for NB-IoT

5.2.3 Cell Selection process

5.2.3.1 Description

The UE shall use one of the following two cell selection procedures:

a) Initial Cell Selection

This procedure requires no prior knowledge of which RF channels are E-UTRA or NB-IoT carriers. The UE shall scan all RF channels in the E-UTRA bands according to its capabilities to find a suitable cell. On each carrier frequency, the UE need only search for the strongest cell. Once a suitable cell is found this cell shall be selected.

b) Stored Information Cell Selection

This procedure requires stored information of carrier frequencies and optionally also information on cell parameters, from previously received measurement control information elements or from previously detected

cells. Once the UE has found a suitable cell the UE shall select it. If no suitable cell is found the Initial Cell Selection procedure shall be started.

NOTE 1: Priorities between different frequencies or RATs provided to the UE by system information or dedicated signalling are not used in the cell selection process.

NOTE 2: If BL UE, UE in enhanced coverage or NB-IoT UE has been provisioned with EARFCN, the UE may use this information during Initial Cell Selection and Stored Information Cell Selection to find a suitable cell.

5.2.3.2 Cell Selection Criterion

For NB-IoT the cell selection criterion is defined in clause 5.2.3.2a.

The cell selection criterion S in normal coverage is fulfilled when:

$Srxlev > 0$ AND $Squal > 0$

where:

$Srxlev = Q_{rxlevmeas} - (Q_{rxlevmin} + Q_{rxlevminoffset}) - Pcompensation - Qoffset_{temp}$

$Squal = Q_{qualmeas} - (Q_{qualmin} + Q_{qualminoffset}) - Qoffset_{temp}$

where:

Srxlev	Cell selection RX level value (dB)
Squal	Cell selection quality value (dB)
Qoffset$_{temp}$	Offset temporarily applied to a cell as specified in TS 36.331 [3] (dB)
Q$_{rxlevmeas}$	Measured cell RX level value (RSRP)
Q$_{qualmeas}$	Measured cell quality value (RSRQ)
Q$_{rxlevmin}$	Minimum required RX level in the cell (dBm). Q$_{rxlevmin}$ is obtained from *q-RxLevMin* in SIB1, SIB3, SIB5, or NR SIB5. When the UE who is camped on a NR cell is evaluating an E-UTRA cell, if Q$_{rxlevminoffsetcell}$ is signalled in NR SIB5 in TS 38.331 [37] for the E-UTRA cell, this cell specific offset is added to *q-RxLevMin* to achieve the required minimum RX level in the E-UTRA cell.
Q$_{qualmin}$	Minimum required quality level in the cell (dB) When the UE who is camped on a NR cell is evaluating an E-UTRA cell, if Q$_{qualminoffsetcell}$ is signalled in NR SIB5 in TS 38.331 [37] for the E-UTRA cell, this cell specific offset is added to achieve the required minimum quality level in the E-UTRA cell.
Q$_{rxlevminoffset}$	Offset to the signalled Q$_{rxlevmin}$ taken into account in the Srxlev evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN TS 23.122 [5]
Q$_{qualminoffset}$	Offset to the signalled Q$_{qualmin}$ taken into account in the Squal evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN TS 23.122 [5]
Pcompensation	If the UE supports the *additionalPmax* in the *NS-PmaxList*, if present, in SIB1, SIB3 and SIB5: $\max(P_{EMAX1} - P_{PowerClass}, 0) - (\min(P_{EMAX2}, P_{PowerClass}) - \min(P_{EMAX1}, P_{PowerClass}))$ (dB); else: if P$_{PowerClass}$ is 14 dBm: $\max(P_{EMAX1} - (P_{PowerClass} - Poffset), 0)$ (dB); else: $\max(P_{EMAX1} - P_{PowerClass}, 0)$ (dB)
P$_{EMAX1}$, P$_{EMAX2}$	Maximum TX power level an UE may use when transmitting on the uplink in the cell (dBm) defined as P$_{EMAX}$ in TS 36.101 [33]. P$_{EMAX1}$ and P$_{EMAX2}$ are obtained from the *p-Max* and the *NS-PmaxList* respectively in SIB1, SIB3 and SIB5 as specified in TS 36.331 [3].
P$_{PowerClass}$	Maximum RF output power of the UE (dBm) according to the UE power class as defined in TS 36.101 [33]

The signalled values Q$_{rxlevminoffset}$ and Q$_{qualminoffset}$ are only applied when a cell is evaluated for cell selection as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN TS 23.122 [5]. During this periodic

search for higher priority PLMN the UE may check the S criteria of a cell using parameter values stored from a different cell of this higher priority PLMN.

If cell selection criterion S in normal coverage is not fulfilled for a cell, UE shall consider itself to be in enhanced coverage if the cell selection criterion S for enhanced coverage is fulfilled, where:

$Q_{rxlevmin}$	UE applies coverage specific value $Q_{rxlevmin\_CE}$ (dBm)
$Q_{qualmin}$	UE applies coverage specific value $Q_{qualmin\_CE}$ (dB)

If cell selection criteria S in normal coverage is fulfilled for a cell, UE may consider itself to be in enhanced coverage if *SystemInformationBlockType1* cannot be acquired but UE is able to acquire *MasterInformationBlock, SystemInformationBlockType1-BR* and *SystemInformationBlockType2*.

If cell selection criterion S in normal coverage is not fulfilled for a cell and UE does not consider itself in enhanced coverage based on coverage specific values $Q_{rxlevmin\_CE}$ and $Q_{qualmin\_CE}$, UE shall consider itself to be in enhanced coverage if UE supports CE Mode B and CE mode B is not restricted by upper layers and the cell selection criterion S for enhanced coverage is fulfilled, where:

$Q_{rxlevmin}$	UE applies coverage specific value $Q_{rxlevmin\_CE1}$ (dBm)
$Q_{qualmin}$	UE applies coverage specific value $Q_{qualmin\_CE1}$ (dB)

For the UE in enhanced coverage, coverage specific values $Q_{rxlevmin\_CE}$ and $Q_{qualmin\_CE}$ (or $Q_{rxlevmin\_CE1}$ and $Q_{qualmin\_CE1}$) are only applied for the suitability check in enhanced coverage (i.e. not used for measurement and reselection thresholds).

5.2.3.2a   Cell Selection Criterion for NB-IoT

If the measurements are performed on the non-anchor carrier and UE meets the requirements specified in TS 36.133 [10] the cell selection criterion S is fulfilled when:

Srxlev > 0

Else, the cell selection criterion S is fulfilled when:

Srxlev > 0 AND Squal > 0

where:

Srxlev = $Q_{rxlevmeas}$ − $Q_{rxlevmin}$ − Pcompensation - $Qoffset_{temp}$

Squal = $Q_{qualmeas}$ − $Q_{qualmin}$ - $Qoffset_{temp}$

where:

Srxlev	Cell selection RX level value (dB)
Squal	Cell selection quality value (dB)
$Qoffset_{temp}$	Offset temporarily applied to a cell as specified in TS 36.331 [3] (dB)
$Q_{rxlevmeas}$	Measured cell RX level value (RSRP) If RSRP is measured on non-anchor carrier of the cell, the measured RSRP value is translated to $Q_{rxlevmeas}$ as below. $Q_{rxlevmeas} = Q_{rxlevmeasNonAnchor} - $ *nrs-PowerOffsetNonAnchor*. Where $Q_{rxlevmeasNonAnchor}$ is the Measured RX level (RSRP) of the non-anchor carrier.
$Q_{qualmeas}$	Measured cell quality value (RSRQ)
$Q_{rxlevmin}$	Minimum required RX level in the cell (dBm) If UE is not authorized for enhanced coverage and $Qoffset_{authorization}$ is valid then $Q_{rxlevmin} = Q_{rxlevmin} + Qoffset_{authorization}$.
$Q_{qualmin}$	Minimum required quality level in the cell (dB)

Pcompensation	If the UE supports the *additionalPmax* in the *NS-PmaxList-NB*, if present, in SIB1-NB, SIB3-NB and SIB5-NB:
	$max(P_{EMAX1} - P_{PowerClass}, 0) - (min(P_{EMAX2}, P_{PowerClass}) - min(P_{EMAX1}, P_{PowerClass}))$ (dB);
	else:
	if $P_{PowerClass}$ is 14 dBm:
	$max(P_{EMAX1} - (P_{PowerClass} - Poffset), 0)$ (dB);
	else:
	$max(P_{EMAX1} - P_{PowerClass}, 0)$ (dB)

P_{EMAX1}, P_{EMAX2}	Maximum TX power level an UE may use when transmitting on the uplink in the cell (dBm) defined as P_{EMAX} in TS 36.101 [33]. P_{EMAX1} and P_{EMAX2} are obtained from the *p-Max* and the *NS-PmaxList-NB* respectively in SIB1-NB, SIB3-NB and SIB5-NB as specified in TS 36.331 [3].
$P_{PowerClass}$	Maximum RF output power of the UE (dBm) according to the UE power class as defined in TS 36.101 [33]

5.2.3.3 CSG cells and Hybrid cells in Cell Selection

In addition to normal cell selection rules a manual selection of CSGs shall be supported by the UE upon request from higher layers as defined in clause 5.5.

5.2.3.4 GSM case in Cell Selection

The cell selection criteria and procedures in GSM are specified in TS 43.022 [9].

5.2.3.5 UTRAN case in Cell Selection

The cell selection criteria and procedures in UTRAN are specified in TS 25.304 [8].

5.2.3.6 NR case in Cell Selection

The cell selection criteria and procedures in NR are specified in TS 38.304 [38].

5.2.4 Cell Reselection evaluation process

5.2.4.1 Reselection priorities handling

Absolute priorities of different E-UTRAN frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCConnectionRelease* or *RRCEarlyDataComplete* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an E-UTRAN frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities (i.e. *cellReselectionPriority* and/or *cellReselectionSubPriority*) provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling, *deprioritisationReq* received in *RRCConnectionReject* and *altFreqPriorities* provided by

dedicated signalling unless specified otherwise. When the UE in *camped normally* state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values). While the UE is camped on a suitable CSG cell in normal coverage, the UE shall always consider the current frequency to be the highest priority frequency (i.e. higher than any of the network configured values), irrespective of any other priority value allocated to this frequency. When the HSDN capable UE is in High-mobility state, the UE shall always consider the HSDN cells to be the highest priority (i.e. higher than any other network configured priorities). When the HSDN capable UE is not in High-mobility state, the UE shall always consider HSDN cells to be the lowest priority (i.e. lower than network configured priorities). If the UE capable of sidelink communication is configured to perform sidelink communication and can only perform the sidelink communication while camping on a frequency, the UE may consider that frequency to be the highest priority. If the UE capable of V2X sidelink communication is configured to perform V2X sidelink communication and can only perform the V2X sidelink communication while camping on a frequency, the UE may consider that frequency to be the highest priority. If the UE capable of V2X sidelink communication is configured to perform V2X sidelink communication and can only use pre-configuration while not camping on a frequency, the UE may consider the frequency providing inter-carrier V2X sidelink configuration to be the highest priority. If the UE is configured to perform both V2X sidelink communication and NR sidelink communication, the UE may consider the frequency providing both V2X sidelink communication and NR sidelink communication configuration to be the highest priority.If the UE is configured to perform V2X sidelink communication and not perform NR sidelink communication, the UE may consider the frequency providing V2X sidelink communication configuration to be the highest priority. If the UE is configured to perform NR sidelink communication and not perform V2X sidelink communication, the UE may consider the frequency providing NR sidelink communication configuration to be the highest priority. If the UE capable of sidelink discovery is configured to perform Public Safety related sidelink discovery and can only perform the Public Safety related sidelink discovery while camping on a frequency, the UE may consider that frequency to be the highest priority.

NOTE 1:   The prioritization among the frequencies which UE considers to be the highest priority frequency is left to UE implementation.

NOTE 1a: The frequency only providing the anchor frequency configuration should not be prioritized for V2X service during cell reselection as specified in TS 36.331[3].

NOTE 1b: When UE is configured to perform NR sidelink communication or V2X sidelink communication performs cell reselection, it may consider the frequencies providing the intra-carrier and inter-carrier configuration have equal priority in cell reselection.

NOTE 1c: The UE is configured to perform V2X sidelink communication or NR sidelink communication, if it has the capability and is authorized for the corresponding sidelink operation.

NOTE 1d: When UE is configured to perform both NR sidelink communication and V2X sidelink communication, but cannot find a frequency which can provide both NR sidelink communication configuration and V2X sidelink communication configuration, UE may consider the frequency providing either NR sidelink communication configuration or V2X sidelink communication configuration to be the highest priority.

If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service and can only receive this MBMS service while camping on a frequency on which it is provided, the UE may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the two following conditions are fulfilled:

1) Either:

- the UE is capable of MBMS service continuity and the reselected cell is broadcasting SIB13; or

- the UE is capable of SC-PTM reception and the reselected cell is broadcasting SIB20;

2) Either:

- SIB15 of the serving cell indicates for that frequency one or more MBMS SAIs included and associated with that frequency in the MBMS User Service Description (USD) TS 26.346 [22] of this service; or

- SIB15 is not broadcast in the serving cell and that frequency is included in the USD of this service.

If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service provided on a downlink only MBMS frequency, on a frequency used by dedicated MBMS cells, on a frequency used by FeMBMS/Unicast-mixed cells as defined in TS 36.300 [2], or on a frequency belonging to PLMN different from its registered PLMN, the UE may consider cell reselection candidate frequencies at which it can

not receive the MBMS service to be of the lowest priority during the MBMS session TS 36.300 [2], as long as the above mentioned condition 1) is fulfilled for the cell on the MBMS frequency which the UE monitors or this cell broadcasts SIB1-MBMS and as long as the above mentioned condition 2) is fulfilled for the serving cell.

NOTE 2: Example scenarios in which the previous down-prioritisation may be needed concerns the cases where camping is not possible, while the UE can only receive this MBMS frequency when camping on a subset of cell reselection candidate frequencies, e.g. the MBMS frequency is a downlink only carrier, the MBMS frequency is used by dedicated MBMS cells, the MBMS frequency is used by FeMBMS/Unicast-mixed cells TS 36.300 [2], or the MBMS frequency belongs to a PLMN different from UE's registered PLMN.

If the UE is not capable of MBMS Service Continuity but has knowledge on which frequency an MBMS service of interest is provided, it may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the reselected cell is broadcasting SIB13.

If the UE is not capable of MBMS Service Continuity but has knowledge on which downlink only frequency, on which frequency used by dedicated MBMS cells, on which frequency used by FeMBMS/Unicast-mixed cells as defined in TS 36.300 [2] or on which frequency belonging to PLMN different from its registered PLMN an MBMS service of interest is provided, it may consider cell reselection candidate frequencies at which it can not receive the MBMS service to be of the lowest priority during the MBMS session TS 36.300 [2] as long as the cell on the MBMS frequency which the UE monitors is broadcasting SIB13 or SIB1-MBMS.

NOTE 3: The UE considers that the MBMS session is ongoing using the session start and end times as provided by upper layers in the USD i.e. the UE does not verify if the session is indicated on MCCH.

In case UE receives *RRCConnectionReject* with *deprioritisationReq*, UE shall consider current carrier frequency and stored frequencies due to the previously received *RRCConnectionReject* with *deprioritisationReq* or all the frequencies of EUTRA to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection is performed on request by NAS TS 23.122 [5].

NOTE 4: Connecting to CDMA2000 does not imply PLMN selection.

NOTE 5: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 36.133 [10] are still applicable.

The UE shall delete priorities or *altFreqPriorities* provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- the optional validity time of *altFreqPriorities* (T323) expires; or

- a PLMN selection is performed on request by NAS TS 23.122 [5].

NOTE 6: Equal priorities between RATs are not supported.

The UE shall only perform cell reselection evaluation for E-UTRAN frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

In case the UE received *RRCConnectionRelease* with *altFreqPriorities*, for E-UTRAN frequencies, the UE shall apply the alternative cell reselection priorities broadcast via *altCellReselectionPriority* and *altCellReselectionSubPriority* in the system information instead of priorities broadcast via *cellReselectionPriority* and *cellReselectionSubPriority*. If the UE received *RRCConnectionRelease* with *altFreqPriorities* and the alternative cell reselection priorities are not broadcast via *altCellReselectionPriority* and *altCellReselectionSubPriority* in the system information, for E-UTRAN frequencies, the UE shall apply the cell reselection priority information broadcast in the system information via *cellReselectionPriority* and *cellReselectionSubPriority*. When *altFreqPriorities* is discarded or deleted, the UE shall apply the cell reselection priority information broadcast in the system information via *cellReselectionPriority* and *cellReselectionSubPriority*.

The UE shall not consider any black listed cells as candidate for cell reselection.

For cell reselection to NR operating with shared spectrum channel access, the UE shall consider only the white listed cells, if configured in SIB24, as candidates for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e., T320 in E-UTRA and NR, T322 in UTRA and T3230 in GERAN), if configured, at inter-RAT cell (re)selection. The UE shall delete *altFreqPriorities* provided by dedicated signalling, if configured, at inter-RAT cell (re)selection.

NOTE 7:	The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

While T360 is running, redistribution target is considered to be the highest priority (i.e. higher than any of the network configured values). UE shall continue to consider the serving frequency as the highest priority until completion of E-UTRAN Inter-frequency Redistribution procedure specified in 5.2.4.10 if triggered on T360 expiry/ stop.

## 5.2.4.2	Measurement rules for cell re-selection

For NB-IoT measurement rules for cell re-selection is defined in clause 5.2.4.2.a.

When evaluating Srxlev and Squal of non-serving cells for reselection purposes, the UE shall use parameters provided by the serving cell.

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils $Srxlev > S_{IntraSearchP}$ and $Squal > S_{IntraSearchQ}$, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for E-UTRAN inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

  - For an E-UTRAN inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current E-UTRA frequency the UE shall perform measurements of higher priority E-UTRAN inter-frequency or inter-RAT frequencies according to TS 36.133 [10].

  - For an E-UTRAN inter-frequency with an equal or lower reselection priority than the reselection priority of the current E-UTRA frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current E-UTRAN frequency:

    - If the serving cell fulfils $Srxlev > S_{nonIntraSearchP}$ and $Squal > S_{nonIntraSearchQ}$, the UE may choose not to perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority unless the UE is triggered to measure an E-UTRAN inter-frequency which is configured with *redistributionInterFreqInfo*.

    - Otherwise, the UE shall perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 36.133 [10].

- If the UE supports relaxed monitoring and *s-SearchDeltaP* is present in *SystemInformationBlockType3*, the UE may further limit the needed measurements, as specified in clause 5.2.4.12.

## 5.2.4.2a	Measurement rules for cell re-selection for NB-IoT

When evaluating Srxlev and Squal of non-serving cells for reselection purposes, the UE shall use parameters provided by the serving cell.

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils $Srxlev > S_{IntraSearchP}$, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for NB-IoT inter-frequencies which are indicated in system information:

  - If the serving cell fulfils $Srxlev > S_{nonIntraSearchP}$, the UE may choose not to perform inter-frequency measurements.

  - Otherwise, the UE shall perform inter-frequency measurements.

- If the UE supports relaxed monitoring and *s-SearchDeltaP* is present in *SystemInformationBlockType3-NB*, the UE may further limit the needed measurements, as specified in clause 5.2.4.12.

5.2.4.3   Mobility states of a UE

Besides Normal-mobility state a High-mobility and a Medium-mobility state are applicable if the parameters (T_{CRmax}, N_{CR_H}, N_{CR_M}, $T_{CRmaxHyst}$ and *cellEquivalentSize*) are sent in the system information broadcast of the serving cell.

State detection criteria:

Medium-mobility state criteria:

- If number of cell reselections during time period T_{CRmax} exceeds N_{CR_M} and not exceeds N_{CR_H}

High-mobility state criteria:

- If number of cell reselections during time period T_{CRmax} exceeds N_{CR_H}

The UE shall not count consecutive reselections between same two cells into mobility state detection criteria if same cell is reselected just after one other reselection. If the UE is capable of HSDN and the *cellEquivalentSize* is configured, the UE counts the number of cell reselections for this cell as *cellEquivalentSize* configured for this cell.

State transitions:

The UE shall:

- if the criteria for High-mobility state is detected:

    - enter High-mobility state.

- else if the criteria for Medium-mobility state is detected:

    - enter Medium-mobility state.

- else if criteria for either Medium- or High-mobility state is not detected during time period $T_{CRmaxHyst}$:

    - enter Normal-mobility state.

If the UE is in High- or Medium-mobility state, the UE shall apply the speed dependent scaling rules as defined in clause 5.2.4.3.1.

5.2.4.3.1   Scaling rules

UE shall apply the following scaling rules:

- If neither Medium- nor Highmobility state is detected:

    - no scaling is applied.

- If High-mobility state is detected:

    - Add the *sf-High* of "Speed dependent ScalingFactor for Q_{hyst}" to Q_{hyst} if sent on system information

    - For E-UTRAN cells multiply $Treselection_{EUTRA}$ by the *sf-High* of "Speed dependent ScalingFactor for $Treselection_{EUTRA}$" if sent on system information

    - For UTRAN cells multiply $Treselection_{UTRA}$ by the *sf-High* of "Speed dependent ScalingFactor for $Treselection_{UTRA}$" if sent on system information

    - For GERAN cells multiply $Treselection_{GERA}$ by the *sf-High* of "Speed dependent ScalingFactor for $Treselection_{GERA}$ state" if sent on system information

    - For CDMA2000 HRPD cells Multiply $Treselection_{CDMA\_HRPD}$ by the *sf-High* of "Speed dependent ScalingFactor for $Treselection_{CDMA\_HRPD}$" if sent on system information

- For CDMA2000 1xRTT cells Multiply Treselection$_{CDMA\_1xRTT}$ by the *sf-High* of "Speed dependent ScalingFactor for Treselection$_{CDMA\_1xRTT}$" if sent on system information

- For NR cells multiply Treselection$_{NR}$ by the *sf-High* of "Speed dependent ScalingFactor for Treselection$_{NR}$" if sent on system information

- If Medium-mobility state is detected:

  - Add the *sf-Medium* of "Speed dependent ScalingFactor for Q$_{hyst}$" to Q$_{hyst}$ if sent on system information

  - For E-UTRAN cells multiply Treselection$_{EUTRA}$ by the *sf-Medium* of "Speed dependent ScalingFactor for Treselection$_{EUTRA}$" if sent on system information

  - For UTRAN cells multiply Treselection$_{UTRA}$ by the *sf-Medium* of "Speed dependent ScalingFactor for Treselection$_{UTRA}$" if sent on system information

  - For GERAN cells multiply Treselection$_{GERA}$ by the *sf-Medium* of "Speed dependent ScalingFactor for Treselection$_{GERA}$" if sent on system information

  - For CDMA2000 HRPD cells Multiply Treselection$_{CDMA\_HRPD}$ by the *sf-Medium* of "Speed dependent ScalingFactor for Treselection$_{CDMA\_HRPD}$" if sent on system information

  - For CDMA2000 1xRTT cells Multiply Treselection$_{CDMA\_1xRTT}$ by the *sf-Medium* of "Speed dependent ScalingFactor for Treselection$_{CDMA\_1xRTT}$" if sent on system information

  - For NR cells multiply Treselection$_{NR}$ by the *sf-Medium* of "Speed dependent ScalingFactor for Treselection$_{NR}$" if sent on system information

In case scaling is applied to any Treselection$_{RAT}$ parameter the UE shall round up the result after all scalings to the nearest second.

5.2.4.4 Cells with cell reservations, access restrictions or unsuitable for normal camping

For the highest ranked cell (including serving cell) according to cell reselection criteria specified in clause 5.2.4.6, for the best cell according to absolute priority reselection criteria specified in clause 5.2.4.5, the UE shall check if the access is restricted according to the rules in clause 5.3.1.

If that cell and other cells have to be excluded from the candidate list, as stated in clause 5.3.1, the UE shall not consider these as candidates for cell reselection. This limitation shall be removed when the highest ranked cell changes.

If the highest ranked cell or best cell according to absolute priority reselection rules is an intra-frequency or inter-frequency cell which is not suitable for a CN type due to being part of the "list of forbidden TAs for roaming" or belonging to a PLMN which is not indicated as being equivalent to the registered PLMN, the UE shall not consider this cell and other cells on the same frequency, as candidates for reselection for the CN type for a maximum of 300s. If the UE enters into state *any cell selection*, any limitation shall be removed. If the UE is redirected under E-UTRAN control to a frequency for which the timer is running, any limitation on that frequency shall be removed.

If the highest ranked cell or best cell according to absolute priority reselection rules is an inter-RAT cell which is not suitable due to being part of the "list of forbidden TAs for roaming" or belonging to a PLMN which is not indicated as being equivalent to the registered PLMN, the UE shall not consider this cell and other cells on the same frequency as candidates for reselection for a maximum of 300s. In case of UTRA further requirements are defined in the TS 25.304 [8]. In case of NR further requirements are defined in the TS 38.304 [38]. If the UE enters into state *any cell selection*, any limitation shall be removed. If the UE is redirected under E-UTRAN control to a frequency for which the timer is running, any limitation on that frequency shall be removed.

If the highest ranked cell or best cell according to absolute priority reselection rules is a CSG cell which is not suitable due to not being a CSG member cell, the UE shall not consider this cell as candidate for cell reselection but shall continue considering other cells on the same frequency for cell reselection.

5.2.4.5 E-UTRAN Inter-frequency and inter-RAT Cell Reselection criteria

For NB-IoT inter-frequency cell reselection shall be based on ranking as defined in clause 5.2.4.6.

If *threshServingLowQ* is provided in *SystemInformationBlockType3* and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority EUTRAN, NR or UTRAN FDD RAT/ frequency fulfils Squal > Thresh$_{X, HighQ}$ during a time interval Treselection$_{RAT}$; or

- A cell of a higher priority UTRAN TDD, GERAN or CDMA2000 RAT/ frequency fulfils Srxlev > Thresh$_{X, HighP}$ during a time interval Treselection$_{RAT}$.

Otherwise, cell reselection to a cell on a higher priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > Thresh$_{X, HighP}$ during a time interval Treselection$_{RAT}$; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority E-UTRAN frequency shall be based on ranking for Intra-frequency cell reselection as defined in clause 5.2.4.6.

If *threshServingLowQ* is provided in *SystemInformationBlockType3* and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < Thresh$_{Serving, LowQ}$ and a cell of a lower priority EUTRAN, NR or UTRAN FDD RAT/ frequency fulfils Squal > Thresh$_{X, LowQ}$ during a time interval Treselection$_{RAT}$; or

- The serving cell fulfils Squal < Thresh$_{Serving, LowQ}$ and a cell of a lower priority UTRAN TDD, GERAN or CDMA2000 RAT/ frequency fulfils Srxlev > Thresh$_{X, LowP}$ during a time interval Treselection$_{RAT}$.

Otherwise, cell reselection to a cell on a lower priority E-UTRAN frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < Thresh$_{Serving, LowP}$ and a cell of a lower priority RAT/ frequency fulfils Srxlev > Thresh$_{X, LowP}$ during a time interval Treselection$_{RAT}$; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a higher priority RAT/ frequency shall take precedence over a lower priority RAT/ frequency, if multiple cells of different priorities fulfil the cell reselection criteria.

The UE shall not perform cell reselection to NR or UTRAN FDD cells for which the cell selection criterion S is not fulfilled.

For cdma2000 RATs, Srxlev is equal to -FLOOR(-2 x 10 x log10 Ec/Io) in units of 0.5 dB, as defined in [18], with Ec/Io referring to the value measured from the evaluated cell.

For cdma2000 RATs, Thresh$_{X, HighP}$ and Thresh$_{X, LowP}$ are equal to -1 times the values signalled for the corresponding parameters in the system information.

In all the above criteria the value of Treselection$_{RAT}$ is scaled when the UE is in the medium or high mobility state as defined in clause 5.2.4.3.1. If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an E-UTRAN frequency, a cell ranked as the best cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, a cell ranked as the best cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

Cell reselection to another RAT, for which Squal based cell reselection parameters are broadcast in system information, shall be performed based on the Squal criteria if the UE supports Squal (RSRQ) based cell reselection to E-UTRAN from all the other RATs provided by system information which UE supports. Otherwise, cell reselection to another RAT shall be performed based on Srxlev criteria.

Cell reselection to NR, for which a cell reselection parameter, *q-RxLevMinSUL* is broadcast in system information and the UE supports SUL, shall be performed based on Srxlev criteria taking the parameter into account.

5.2.4.6 Intra-frequency and equal priority inter-frequency Cell Reselection criteria

The cell-ranking criterion R_s for serving cell and R_n for neighbouring cells is defined by:

$$R_s = Q_{meas,s} + Q_{Hyst} - Qoffset_{temp} + Qoffset_{SCPTM}$$

$$R_n = Q_{meas,n} - Qoffset - Qoffset_{temp} + Qoffset_{SCPTM}$$

where:

Q_{meas}	RSRP measurement quantity used in cell reselections.
Qoffset	For intra-frequency: Equals to $Qoffset_{s,n}$, if $Qoffset_{s,n}$ is valid, otherwise this equals to zero. For inter-frequency: Except for NB-IoT, equals to $Qoffset_{s,n}$ plus $Qoffset_{frequency}$, if $Qoffset_{s,n}$ is valid, otherwise this equals to $Qoffset_{frequency}$. For NB-IoT equals to $QoffsetDedicated_{frequency}$ for any frequency other than the frequency of the dedicated frequency offset, if $QoffsetDedicated_{frequency}$ is valid, otherwise this equals to $Qoffset_{frequency}$ (if $QoffsetDedicated_{frequency}$ is valid $Qoffset_{frequency}$ is not used).
$Qoffset_{temp}$	Offset temporarily applied to a cell as specified in TS 36.331 [3]
$Qoffset_{SCPTM}$	Offset temporarily applied to an SC-PTM frequency as specified below. The offset is applied to all cells on the SC-PTM frequency. If $Qoffset_{SCPTM}$ is valid, Qoffset for inter-frequency neighbour cells is not used.

If the NB-IoT UE or UE in enhanced coverage is capable of SC-PTM reception and is receiving or interested to receive an MBMS service and can only receive this MBMS service while camping on a frequency on which it is provided (SC-PTM frequency), the UE considers $Qoffset_{SCPTM}$ to be valid during the MBMS session TS 36.300 [2] as long as the following condition is fulfilled:

Either:

- SIB15 (or SIB15-NB) of the serving cell indicates for that frequency one or more MBMS SAIs included in the MBMS User Service Description (USD) TS 26.346 [22] of this service; or

- SIB15 (or SIB15-NB) is not broadcast in the serving cell and that frequency is included in the USD of this service.

NOTE: UE should search for a higher ranked cell on another frequency for cell reselection as soon as possible after the UE stops using $Qoffset_{SCPTM}$.

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2 (5.2.3.2a for NB-IoT), but may exclude all CSG cells that are known by the UE not to be CSG member cells.

The cells shall be ranked according to the R criteria specified above, deriving $Q_{meas,n}$ and $Q_{meas,s}$ and calculating the R values using averaged RSRP results.

If a cell is ranked as the best cell the UE shall perform cell reselection to that cell. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

In all cases, the UE shall reselect the new cell, only if the following conditions are met:

- the new cell is better ranked than the serving cell during a time interval $Treselection_{RAT}$;

- more than 1 second has elapsed since the UE camped on the current serving cell.

When the UE uses infinite dBs for $Qoffset_{SCPTM}$, the UE shall use $Qoffset_{SCPTM}$ zero and rank the cells on the SC-PTM frequency(ies) only first. If the UE cannot find a suitable cell on an SC-PTM frequency, the UE shall rank the cells on all frequencies.

5.2.4.6a　　Reselection for enhanced coverage

Ranking as defined in clause 5.2.4.6 is applied for intra-frequency and inter-frequency cell reselection (irrespective of configured frequency priorities, if any) while the UE is in enhanced coverage.

If a UE considers itself to be in enhanced coverage when S criteria for normal coverage is fulfilled, the absolute priority reselection cell reselection criteria as defined in clause 5.2.4.5 is applied for inter-frequency cell reselection.

5.2.4.7　　Cell reselection parameters in system information broadcasts

Cell reselection parameters are broadcast in system information and are read from the serving cell as follows:

altCellReselectionPriority

This specifies the absolute priority of E-UTRAN frequency used by the UE, if *altFreqPriorities* is configured.

altCellReselectionSubPriority

This specifies fractional priority value added to *altCellReselectionPriority* for E-UTRAN frequency used by the UE, if *altFreqPriorities* is configured.

cellReselectionPriority

This specifies the absolute priority for E-UTRAN frequency or NR frequency or UTRAN frequency or group of GERAN frequencies or band class of CDMA2000 HRPD or band class of CDMA2000 1xRTT.

cellReselectionSubPriority

This specifies the fractional priority value added to cellReselectionPriority for E-UTRAN frequency or NR frequency.

nrs-PowerOffsetNonAnchor

This specifies the power offset of the downlink narrowband reference-signal EPRE of the anchor/non-anchor carrier relative to the anchor carrier for NB-IoT UE.

Poffset

This specifies the offset for 14 dBm power class for BL or NB-IoT UE.

$Qoffset_{authorization}$

This specifies the offset for enhanced coverage authorization for NB-IoT.

$Qoffset_{s,n}$

This specifies the offset between the two cells.

$Qoffset_{frequency}$

Frequency specific offset for equal priority E-UTRAN frequencies.

$Qoffset_{scptm}$

This specifies the offset to be used for cell re-selection for SC-PTM service reception for BL UE, UE in enhanced coverage and NB-IoT UE. The same offset is applicable to all frequencies providing MBMS services via SC-PTM.

$Qoffset_{temp}$

This specifies the additional offset to be used for cell selection and re-selection. It is temporarily used in case the T300 expires consecutively on the cell as specified in TS 36.331 [3].

Q_{hyst}

This specifies the hysteresis value for ranking criteria.

$Q_{qualmin}$

This specifies the minimum required quality level in the cell in dB.

$Q_{qualmin\_CE}$, $Q_{qualmin\_CE1}$

This specifies the coverage specific minimum required quality level in the cell in dB.

$Q_{rxlevmin}$

This specifies the minimum required Rx level in the cell in dBm.

$Q_{rxlevmin\_CE}$, $Q_{rxlevmin\_CE1}$

This specifies the coverage specific minimum required Rx level in the cell in dBm.

RedistributionFactorFreq

This specifies the redistribution factor for a neighbour E-UTRAN frequency.

RedistributionFactorCell

This specifies the redistribution factor for a neighbour E-UTRAN cell.

RedistributionFactorServing

This specifies the redistribution factor for serving cell or serving frequency.

$Treselection_{RAT}$

This specifies the cell reselection timer value. For each target E-UTRA frequency and for each RAT (other than E-UTRA) a specific value for the cell reselection timer is defined, which is applicable when evaluating reselection within E-UTRAN or towards other RAT (i.e. $Treselection_{RAT}$ for E-UTRAN is $Treselection_{EUTRA}$, for NR $Treselection_{NR}$, for UTRAN $Treselection_{UTRA}$ for GERAN $Treselection_{GERA}$, for $Treselection_{CDMA\_HRPD}$, and for $Treselection_{CDMA\_1xRTT}$). For NB-IoT intra-frequency and inter-frequency specific values for the cell reselection timer are defined, which are applicable when evaluating reselection within NB-IoT.

   NOTE: $Treselection_{RAT}$ is not sent on system information, but used in reselection rules by the UE for each RAT.

$Treselection_{EUTRA\_CE}$

This specifies the cell reselection timer value $Treselection_{RAT}$ for E-UTRAN when a neighbour cell is evaluated for camping in enhanced coverage. The parameter can be set per E-UTRAN frequency.

$Treselection_{EUTRA}$

This specifies the cell reselection timer value $Treselection_{RAT}$ for E-UTRAN. The parameter can be set per E-UTRAN frequency TS 36.331 [3].

$Treselection_{NR}$

This specifies the cell reselection timer value $Treselection_{RAT}$ for NR.

$Treselection_{NB\text{-}IoT\_Intra}$

This specifies the intra-frequency cell reselection timer value $Treselection_{RAT}$ for NB-IoT.**$Treselection_{NB\text{-}IoT\_Inter}$**

This specifies the inter-frequency cell reselection timer value $Treselection_{RAT}$ for NB-IoT.

$Treselection_{UTRA}$

This specifies the cell reselection timer value $Treselection_{RAT}$ for UTRAN.

$Treselection_{GERA}$

This specifies the cell reselection timer value $Treselection_{RAT}$ for GERAN.

Treselection$_{CDMA\_HRPD}$

This specifies the cell reselection timer value Treselection$_{RAT}$ for CDMA HRPD.

Treselection$_{CDMA\_1xRTT}$

This specifies the cell reselection timer value Treselection$_{RAT}$ for CDMA 1xRTT.

Thresh$_{X, HighP}$

This specifies the Srxlev threshold (in dB) used by the UE when reselecting towards a higher priority RAT/ frequency than the current serving frequency. Each frequency of E-UTRAN, NR and UTRAN, each group of GERAN frequencies, each band class of CDMA2000 HRPD and CDMA2000 1xRTT might have a specific threshold.

Thresh$_{X, HighQ}$

This specifies the Squal threshold (in dB) used by the UE when reselecting towards a higher priority RAT/ frequency than the current serving frequency. Each frequency of E-UTRAN, NR and UTRAN FDD might have a specific threshold.

Thresh$_{X, LowP}$

This specifies the Srxlev threshold (in dB) used by the UE when reselecting towards a lower priority RAT/ frequency than the current serving frequency. Each frequency of E-UTRAN, NR and UTRAN, each group of GERAN frequencies, each band class of CDMA2000 HRPD and CDMA2000 1xRTT might have a specific threshold.

Thresh$_{X, LowQ}$

This specifies the Squal threshold (in dB) used by the UE when reselecting towards a lower priority RAT/ frequency than the current serving frequency. Each frequency of E-UTRAN, NR and UTRAN FDD might have a specific threshold.

Thresh$_{Serving, LowP}$

This specifies the Srxlev threshold (in dB) used by the UE on the serving cell when reselecting towards a lower priority RAT/ frequency.

Thresh$_{Serving, LowQ}$

This specifies the Squal threshold (in dB) used by the UE on the serving cell when reselecting towards a lower priority RAT/ frequency.

S$_{IntraSearchP}$

This specifies the Srxlev threshold (in dB) for intra-frequency measurements.

S$_{IntraSearchQ}$

This specifies the Squal threshold (in dB) for intra-frequency measurements.

S$_{nonIntraSearchP}$

This specifies the Srxlev threshold (in dB) for E-UTRAN inter-frequency and inter-RAT measurements.

S$_{nonIntraSearchQ}$

This specifies the Squal threshold (in dB) for E-UTRAN inter-frequency and inter-RAT measurements.

S$_{SearchDeltaP}$

This specifies the Srxlev delta threshold (in dB) during relaxed monitoring.

5.2.4.7.1 Speed dependant reselection parameters

T$_{CRmax}$

This specifies the duration for evaluating allowed amount of cell reselection(s).

N_{CR_M}

This specifies the maximum number of cell reselections to enter Medium-mobility state.

N_{CR_H}

This specifies the maximum number of cell reselections to enter High-mobility state.

$T_{CRmaxHyst}$

This specifies the additional time period before the UE can enter Normal-mobility state.

Speed dependent ScalingFactor for Qhyst

This specifies scaling factor for Qhyst in *sf-High* for High-mobility state and *sf-Medium* for Medium-mobility state

Speed dependent ScalingFactor for Treselection$_{NR}$

This specifies scaling factor for Treselection$_{NR}$ in *sf-High* for High-mobility state and *sf-Medium* for Medium-mobility state

Speed dependent ScalingFactor for Treselection$_{EUTRA}$

This specifies scaling factor for Treselection$_{EUTRA}$ in *sf-High* for High-mobility state and *sf-Medium* for Medium-mobility state

Speed dependent ScalingFactor for Treselection$_{UTRA}$

This specifies scaling factor for Treselection$_{UTRA}$ in *sf-High* for High-mobility state and *sf-Medium* for Medium-mobility state

Speed dependent ScalingFactor for Treselection$_{GERA}$

This specifies scaling factor for Treselection$_{GERA}$ in H *sf-High* for High-mobility state and *sf-Medium* for Medium-mobility state

Speed dependent ScalingFactor for Treselection$_{CDMA\_HRPD}$

This specifies scaling factor for Treselection$_{CDMA\_HRPD}$ in *sf-High* for High mobility state and *sf-Medium* for Medium-mobility state

Speed dependent ScalingFactor for Treselection$_{CDMA\_1xRTT}$

This specifies scaling factor for Treselection$_{CDMA\_1xRTT}$ in *sf-High* for High mobility state and *sf-Medium* for Medium-mobility state

5.2.4.8 Cell reselection with CSG cells

5.2.4.8.1 Cell reselection from a non-CSG cell to a CSG cell

In addition to normal cell reselection, the UE shall use an autonomous search function to detect at least previously visited CSG member cells on non-serving frequencies, including inter-RAT frequencies, according to the performance requirements specified in TS 36.133 [10], when at least one CSG ID with associated PLMN identity is included in the UE's CSG whitelist. The UE may also use autonomous search on the serving frequency. The UE shall disable the autonomous search function for CSG cells if the UE's CSG whitelist is empty.

   NOTE: The UE autonomous search function, per UE implementation, determines when and/or where to search for CSG member cells.

If the UE detects one or more suitable CSG cells on different frequencies, then the UE shall reselect to one of the detected cells irrespective of the frequency priority of the cell the UE is currently camped on, if the concerned CSG cell is the highest ranked cell on that frequency.

If the UE detects a suitable CSG cell on the same frequency, it shall reselect to this cell as per normal reselection rules (5.2.4.6.).

If the UE detects one or more suitable CSG cells on another RAT, the UE shall reselect to one of them according to TS 25.304 [19].

5.2.4.8.2 Cell reselection from a CSG cell

While camped on a suitable CSG cell, the UE shall apply the normal cell reselection rules as defined in clause 5.2.4.

To search for suitable CSG cells on non-serving frequencies, the UE may use an autonomous search function. If the UE detects a CSG cell on a non-serving frequency, the UE may reselect to the detected CSG cell if it is the highest ranked cell on its frequency.

If the UE detects one or more suitable CSG cells on another RAT, the UE may reselect to one of them if allowed according to TS 25.304 [19].

5.2.4.9 Cell reselection with Hybrid cells

In addition to normal cell reselection rules, the UE shall use an autonomous search function to detect at least previously visited hybrid cells whose CSG ID and associated PLMN identity is in the UE's CSG whitelist according to the performance requirements specified in TS 36.133 [10]. The UE shall treat detected hybrid cells as CSG cells if the CSG ID and associated PLMN identity of the hybrid cell is in the UE's CSG whitelist and as normal cells otherwise.

5.2.4.10 E-UTRAN Inter-frequency Redistribution procedure

If a UE is redistribution capable and *redistributionServingInfo* is included in *SystemInformationBlockType3* and *redistributionInterFreqInfo* is included in *SystemInformationBlockType5* and the UE is not configured with dedicated priorities and

- if T360 is not running and if *redistrOnPagingOnly* is not present in *SystemInformationBlockType3*; or

- if T360 expires and if *redistrOnPagingOnly* is not present in *SystemInformationBlockType3*; or

- if *Paging* message is received and the *redistributionIndication* is included:

  - Perform inter-frequency measurement as specified in 5.2.4.2;

  - Once measurement results are available perform redistribution target selection as specified in 5.2.4.10.1;

  - Start T360.

The UE shall stop T360 and cease to consider a frequency or cell to be redistribution target when:

  - the UE enters RRC_CONNECTED state; or

  - T360 expires; or

  - if *Paging* message is received and the *redistributionIndication* is included while T360 is running; or

  - the UE reselects a cell not belonging to redistribution target.

5.2.4.10.1 Redistribution target selection

The UE shall compile a sorted list of one or more candidate redistribution targets, and for each candidate entry [j] a valid *redistrFactor[j]*, in which entries are added in increasing index order starting with index 0 as follows:

- for the serving frequency (*redistributionFactorServing* is included in *SystemInformationBlockType3* whenever redistribution is configured*)*:

  - the serving cell if *redistributionFactorCell* is included;

  - otherwise the serving frequency;

  - In both cases, *redistrFactor*[0] is set to *redistributionFactorServing*;

- for each entry in *InterFreqCarrierFreqList* and subsequent for each entry in *InterFreqCarrierFreqListExt:*

- the cell ranked as the best cell on this frequency according to clause 5.2.4.6 if *redistributionNeighCellList* is configured and includes this cell;

- otherwise, the concerned frequency if *redistributionFactorFreq* is configured and if at least one cell on the frequency fullfills the cell selection criterion S defined in 5.2.3.2;

- If the cell is included, *redistrFactor*[j] is set to the corresponding *redistributionFactorCell*; If the frequency is included, *redistrFactor*[j] is set to the corresponding *redistributionFactorFreq*;

The UE shall choose a redistribution target as follows:

- If [0], the UE shall choose the frequency or the cell corresponding to redistrFactor[0] as its redistribution target or;

- If , then the UE shall choose the frequency or cell corresponding to *redistrFactor*[i] as its redistribution target;

If there are no redistribution candidates apart from the serving frequency or cell, the redistrRange[0] = 1.

Otherwise, the redistrRange[i] of E-UTRAN frequency or cell is defined by:

$$redistrRange[i] = \frac{redistrFactor[i]}{\sum_{j=0}^{j=(maxCandidates-1)} redistrFactor[j]}$$

Where: maxCandidates is the total number of frequencies/cells with valid redistrFactor[j].

5.2.4.11   Cell reselection or CN type change when storing UE AS context

For UEs storing UE AS context and *resumeIdentity* as specified in TS 36.331 [3], upon cell reselection to another RAT or upon reselecting to another CN type, the UE shall discard the stored UE AS context and *resumeIdentity*.

5.2.4.12   Relaxed monitoring

5.2.4.12.0   Relaxed monitoring measurement rules

When the UE is required to perform intra-frequency or inter-frequency measurement according to the measurement rules in clause 5.2.4.2 or 5.2.4.2a, the UE may choose not to perform intra-frequency or inter-frequency measurements when:

- The relaxed monitoring criterion in clause 5.2.4.12.1 is fulfilled for a period of $T_{SearchDeltaP}$, and

- Less than 24 hours have passed since measurements for cell reselection were last performed, and

- The UE has performed intra-frequency or inter-frequency measurements for at least $T_{SearchDeltaP}$ after selecting or reselecting a new cell.

5.2.4.12.1   Relaxed monitoring criterion

The relaxed monitoring criterion is fulfilled when:

- $(Srxlev_{Ref} - Srxlev) < S_{SearchDeltaP}$

Where:

- Srxlev = current Srxlev value of the serving cell (dB).

- $Srxlev_{Ref}$ = reference Srxlev value of the serving cell (dB), set as follows:

- After selecting or reselecting a new cell, or

- If $(Srxlev - Srxlev_{Ref}) > 0$, or

- If the relaxed monitoring criterion has not been met for $T_{SearchDeltaP}$:

  - the UE shall set the value of $Srxlev_{Ref}$ to the current Srxlev value of the serving cell;

- $T_{SearchDeltaP}$ = 5 minutes, or the eDRX cycle length if eDRX is configured and the eDRX cycle length is longer than 5 minutes.

5.2.4.13   Cell reselection or CN type change in RRC_INACTIVE state

For UE in the RRC_INACTIVE state, upon cell reselection to another RAT or CN type change, UE transitions from RRC_INACTIVE to RRC_IDLE and performs actions as specified in TS 36.331 [3].

5.2.5   Void

5.2.6   Camped Normally state

This state is applicable for RRC_IDLE and RRC_INACTIVE state.

When camped normally, the UE shall perform the following tasks:

- monitor the paging channel of the cell as specified in clause 7 according to information sent in system information;

- monitor relevant System Information as specified in TS 36.331 [3];

- perform necessary measurements for the cell reselection evaluation procedure;

- execute the cell reselection evaluation process on the following occasions/triggers:

  1) UE internal triggers, so as to meet performance as specified in TS 36.133 [10];

  2) When information on the BCCH or BR-BCCH used for the cell reselection evaluation procedure has been modified.

5.2.7   Cell Selection at transition to RRC_IDLE or RRC_INACTIVE state

For NB-IoT cell selection at transition to RRC_IDLE state is defined in clause 5.2.7a.

At reception of *RRCConnectionRelease* message or *RRCEarlyDataComplete* message to move the UE into RRC_IDLE or RRC_INACTIVE, UE shall attempt to camp on a suitable cell according to *redirectedCarrierInfo*, if included in the *RRCConnectionRelease* message or *RRCEarlyDataComplete* message. If the UE cannot find a suitable cell, the UE is allowed to camp on any suitable cell of the indicated RAT. If the *RRCConnectionRelease* message or *RRCEarlyDataComplete* message does not contain the *redirectedCarrierInfo* UE shall attempt to select a suitable cell on an EUTRA carrier. If no suitable cell is found according to the above, the UE shall perform a cell selection starting with Stored Information Cell Selection procedure in order to find a suitable cell to camp on.

When returning to RRC_IDLE or RRC_INACTIVE state after UE moved to RRC_CONNECTED state from *camped on any cell* state, UE shall attempt to camp on an acceptable cell according to *redirectedCarrierInfo*, if included in the *RRCConnectionRelease* message. If the UE cannot find an acceptable cell, the UE is allowed to camp on any acceptable cell of the indicated RAT. If the *RRCConnectionRelease* message does not contain *redirectedCarrierInfo* UE shall attempt to select an acceptable cell on an EUTRA carrier. If no acceptable cell is found according to the above, the UE shall continue to search for an acceptable cell of any PLMN in state *any cell selection*.

5.2.7a   Cell Selection at transition to RRC_IDLE state for NB-IoT

At reception of *RRCConnectionRelease-NB* message or *RRCEarlyDataComplete-NB* message to move the UE into RRC_IDLE, UE shall attempt to camp on a suitable cell according to *redirectedCarrierInfo*, if included in the *RRCConnectionRelease-NB* message or *RRCEarlyDataComplete-NB* message. If the UE cannot find a suitable cell, the UE is allowed to camp on a suitable cell of any NB-IoT carrier. If the *RRCConnectionRelease-NB* message or *RRCEarlyDataComplete-NB* message does not contain the *redirectedCarrierInfo* UE shall attempt to select a suitable cell on a NB-IoT carrier.

5.2.8   Any Cell Selection state

For NB-IoT Any Cell Selection state is defined in clause 5.2.8a.

This state is applicable for RRC_IDLE and RRC_INACTIVE state. In this state, the UE shall perform cell selection process to find a suitable cell. If the cell selection process fails to find a suitable cell after a complete scan of all RATs and all frequency bands supported by the UE, the UE shall attempt to find an acceptable cell of any PLMN to camp on, trying all RATs that are supported by the UE and searching first for a high quality cell, as defined in clause 5.1.2.2.

The UE, which is not camped on any cell, shall stay in this state.

5.2.8a   Any Cell Selection state for NB-IoT

In this state, the UE shall attempt to find a suitable cell of any PLMN to camp on and searching first for a high quality cell, as defined in clause 5.1.2.2.

The UE, which is not camped on any cell, shall stay in this state until a suitable cell is found.

5.2.9   Camped on Any Cell state

In this state, the UE shall perform the following tasks:

- monitor the paging channel of the cell as specified in clause 7 according to information sent in system information;

- monitor relevant System Information as specified in TS 36.331 [3];

- perform necessary measurements for the cell reselection evaluation procedure;

- execute the cell reselection evaluation process on the following occasions/triggers:

    1) UE internal triggers, so as to meet performance as specified in TS 36.133 [10];

    2) When information on the BCCH or BR-BCCH used for the cell reselection evaluation procedure has been modified;

- regularly attempt to find a suitable cell trying all frequencies of all RATs that are supported by the UE. If a suitable cell is found, UE shall move to *camped normally* state;

- if the UE supports voice services and the current cell does not support emergency call as indicated in System information specified in TS 36.331 [3], the UE should perform cell selection/ reselection to an acceptable cell of any supported RAT regardless of priorities provided in system information from current cell, if no suitable cell is found.

    NOTE: The UE is allowed to not perform reselection to an inter-frequency E-UTRAN cell in order to prevent camping on a cell on which it cannot initiate an IMS emergency call.

5.3   Cell Reservations and Access Restrictions

There are two mechanisms which allow an operator to impose cell reservations or access restrictions. The first mechanism uses indication of cell status and special reservations for control of cell selection and reselection procedures. The second mechanism, referred to as Access Control, shall allow preventing selected classes of users or ACDC categories from sending initial access messages for load control reasons. For Access Control based on Access Classes, at subscription, one or more Access Classes are allocated to the subscriber and stored in the USIM TS 22.011 [4]. For Access Control based on ACDC categories, at subscription at least four ACDC categories are allocated to the subscriber and stored in the ACDC MO TS 24.105 [31] or USIM TS 31.102 [32].

IAB-MT does not apply the access control.

5.3.1   Cell status and cell reservations

Cell status and cell reservations are indicated in the *SystemInformationBlockType1* message (or *SystemInformationBlockType1-BR* message or *SystemInformationBlockType1-NB* message) TS 36.331 [3] by means of the following fields:

- *cellBarred* (IE type: "barred" or "not barred")
  This field indicates if the cell is barred for connectivity to EPC.
  This field is ignored by the UEs supporting *crs-IntfMitig* while *crs-IntfMitigEnabled* is included in SIB1.
  This field is ignored by the BL UEs or UEs in CE supporting *ce-CRS-IntfMitig* while *crs-IntfMigitNumPRBs* is included in SIB1-BR.
  In case of multiple EPC PLMNs indicated in SIB1/SIB1-BR, this field is common for all EPC PLMNs

  NOTE 1: IAB-MT ignores the *cellBarred*, *cellReservedForOperatorUse* and *intraFreqReselection* (i.e. treats *intraFreqReselection* as if it was set to *allowed*) as defined in TS 36.331 [3].

- *cellBarred-5GC* (IE type: "barred" or "not barred")
  This field indicates if the cell is barred for connectivity to 5GC.
  This field is ignored if the UE does not support E-UTRA connected to 5GC or if the UE supports network-based CRS interference mitigation and *nw-BasedCRS-InterferenceMitigation* is included in *SystemInformationBlockType1*.
  In case of multiple 5GC PLMNs indicated in SIB1, this field is common for all 5GC PLMNs.

- *cellReservedForOperatorUse* (IE type: "reserved" or "not reserved")
  This field indicates if the cell is reserved for operator use.
  This field is ignored by the UEs supporting *crs-IntfMitig* while *crs-IntfMitigEnabled* is included in SIB1.
  This field is ignored by the BL UEs or UEs in CE supporting *ce-CRS-IntfMitig* while *crs-IntfMigitNumPRBs* is included in SIB1-BR.
  In case of multiple EPC or 5GC PLMNs indicated in SIB1/SIB1-BR, this field is specified per EPC or 5GC PLMN.

- *cellBarred-CRS* (IE type: "barred" or "not barred")
  This field indicates if the cell is barred for connectivity to EPC for UEs supporting network-based CRS interference mitigation.
  barred means the cell is barred for UEs supporting *crs-IntfMitig* while *crs-IntfMitigEnabled* is included in SIB1.
  For BL UEs or UEs in CE capable of *ce-CRS-IntfMitig*, *barred* means the cell is barred while *crs-IntfMitigNumPRBs* is included in SIB1-BR.
  This field is ignored by the UE if the UE does not support CRS interference mitigation or while *crs-IntfMitigConfig* is not included in SIB1 (SIB1-BR for BL UEs or UEs in CE).
  In case of multiple PLMNs indicated in SIB1/SIB1-BR, this field is common for all PLMNs.

- *cellBarred-5GC-CRS* (IE type: "barred" or "not barred")
  This field indicates if the cell is barred for connectivity to 5GC for UEs supporting network-based CRS interference mitigation.
  This field is ignored if the UE does not support E-UTRA connected to 5GC or network-based CRS interference mitigation.
  In case of multiple 5GC PLMNs indicated in SIB1, this field is common for all 5GC PLMNs.

- *cellReservedForOperatorUse-CRS* (IE type: "reserved" or "not reserved")
  This field indicates if the cell is reserved for operator use for UEs supporting network-based CRS interference mitigation.
  reserved means the cell is "reserved" for operator use for UEs supporting *crs-IntfMitig* while *crs-IntfMitigEnabled* is included in SIB1.
  For BL UEs or UEs in CE capable of *ce-CRS-IntfMitig*, *reserved* means the cell is "reserved" for operator use while *crs-IntfMitigNumPRBs* is included in SIB1-BR.
  This field is ignored if the UE does not support CRS interference mitigation or while *crs-IntfMitigConfig* is not included in SIB1 (SIB1-BR for BL UEs or UEs in CE).
  In case of multiple PLMNs indicated in SIB1/SIB1-BR, this field is specified per PLMN.

- *iab-Support* (IE type: "true")

Indicated in *SIB1* message. In case of multiple PLMNs indicated in *SIB1*, this field is specified per PLMN. This field indicates if the cell is barred for IAB node or the cell does not support IAB node, or both. When this field is absent, the IAB node shall treat this cell as if cell status is barred.

The following description for handling of barred and reserved cells is per CN type. If the UE supports more than one CN type, the UE shall only exclude a cell as candidate for selection/reselection if it is excluded for both CN types.

NOTE 2: Fields *cellBarred-CRS* and *cellReservedForOperatorUse-CRS* are not indicated in *SystemInformationBlockType1-NB*

When cell status is indicated as "not barred" and "not reserved" for operator use,

- All UEs shall treat this cell as candidate during the cell selection and cell reselection procedures.

When cell status is indicated as "not barred" and "reserved" for operator use for any PLMN,

- UEs assigned to Access Class 11 or 15 operating in their HPLMN/EHPLMN shall treat this cell as candidate during the cell selection and reselection procedures if the field *cellReservedForOperatorUse* for that PLMN set to "reserved".

- UEs assigned to an Access Class in the range of 0 to 9, 12 to 14 shall behave as if the cell status is "barred" in case the cell is "reserved for operator use" for the registered PLMN or the selected PLMN.

NOTE 3: ACs 11, 15 are only valid for use in the HPLMN/ EHPLMN; ACs 12, 13, 14 are only valid for use in the home country TS 22.011 [4].

When cell status "barred" is indicated or to be treated as if the cell status is "barred",

- The UE is not permitted to select/reselect this cell, not even for emergency calls.

- The UE shall consider other cells for cell selection/reselection according to the following rule:

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *MasterInformationBlock (or MasterInformationBlock-NB), the SystemInformationBlockType1 (or SystemInformationBlockType1-BR* message or *SystemInformationBlockType1-NB),* or the *SystemInformationBlockType2 (or SystemInformationBlockType2-NB)*:

    - the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.

    - the UE may select another cell on the same frequency if the selection criteria are fulfilled.

    - the UE may select the same cell in normal coverage if the UE was barred in the cell due to being unable to acquire *MasterInformationBlock, SystemInformationBlockType1-BR*, or *SystemInformationBlockType2* in enhanced coverage, but was able to acquire *MasterInformationBlock, SystemInformationBlockType1*, and *SystemInformationBlockType2* in normal coverage, if the selection criteria are fulfilled.

    - the UE may select the same cell in enhanced coverage if the UE was barred in the cell due to being unable to acquire *MasterInformationBlock, SystemInformationBlockType1*, or *SystemInformationBlockType2* in normal coverage, but was able to acquire *MasterInformationBlock, SystemInformationBlockType1-BR*, and *SystemInformationBlockType2*, if the selection criteria are fulfilled.

- else

    - If the cell is a CSG cell:

        - the UE may select another cell on the same frequency if the selection/reselection criteria are fulfilled.

    - else

        - If the field *intraFreqReselection* in field *cellAccessRelatedInfo* in *SystemInformationBlockType1 (or SystemInformationBlockType1-BR* message or *SystemInformationBlockType1-NB)* message is set to "allowed", the UE may select another cell on the same frequency if re-selection criteria are fulfilled.

            - The UE shall exclude the barred cell as a candidate for cell selection/reselection for 300 seconds.

- If the field *intraFreqReselection* in field *cellAccessRelatedInfo* in *SystemInformationBlockType1* (or *SystemInformationBlockType1-BR* message or *SystemInformationBlockType1-NB*) message is set to "not allowed" the UE shall not re-select a cell on the same frequency as the barred cell;

  - The UE shall exclude the barred cell and the cells on the same frequency as a candidate for cell selection/reselection for 300 seconds.

The cell selection of another cell may also include a change of RAT or, if the previous and selected cell are both E-UTRA cells, a change of the CN type.

5.3.2   Access control

For UE camping on E-UTRA connected to EPC, information on cell access restrictions associated with the Access Classes or ACDC categories is broadcast as system information, TS 36.331 [3]. For UE camping on E-UTRA connected to 5GC, information on cell access restrictions associated with Access Categories and Identities is broadcast as system information, TS 36.331 [3].

For UE camping on E-UTRA connected to EPC, the UE shall ignore Access Class or ACDC category related cell access restrictions when selecting a cell to camp on, i.e. it shall not reject a cell for camping on because access on that cell is not allowed for any of the Access Classes or ACDC categories of the UE. A change of the indicated access restriction shall not trigger cell reselection by the UE. For UE camping on E-UTRA connected to 5GC, the UE shall ignore Access Category and Identity related cell access restrictions for cell reselection. A change of the indicated access restriction shall not trigger cell reselection by the UE.

For UE camping on E-UTRA connected to EPC, access Class or ACDC category related cell access restrictions shall be checked by the UE when starting RRC connection establishment procedure as specified in TS 36.331 [3]. For UE camping on E-UTRA connected to 5GC, Access Category and Identity related cell access restrictions shall be checked by the UE for NAS initiated access attempts and RNAU as specified in TS 36.331 [3].

5.3.3   Emergency call

A restriction on emergency calls, if needed, is indicated by the field *ac-BarringForEmergency* TS 36.331 [3]. If access class 10 is indicated as barred in a cell, UEs with access class 0 to 9 or without an IMSI are not allowed to initiate emergency calls in this cell. For UEs with access classes 11 to 15, emergency calls are not allowed if both access class 10 and the relevant access class (11 to 15) are barred. Otherwise, emergency calls are allowed for those UEs.

Full details of operation under "Access class barred list" are described in TS 22.011 [4].

For E-UTRA connected to 5GC, the restriction on emergency calls is indicated by access control information of access category 2 under unified access control TS 36.331 [3].

5.4   Tracking Area registration

In the UE, the AS shall report tracking area information to the NAS.

If the UE reads more than one PLMN identity in the current cell, the UE shall report the found PLMN identities that make the cell suitable in the tracking area information to NAS.

The NAS part of the location registration process is specified in TS 23.122 [5].

Actions for the UE AS upon reception of Location Registration reject are specified in TS 22.011 [4] and TS 24.301 [16].

5.5   Support for manual CSG selection

5.5.1   E-UTRA case

In the UE on request of NAS, the AS shall scan all RF channels in the E-UTRA bands according to its capabilities to find available CSGs. On each carrier, the UE shall at least search for the strongest cell, read its system information and

report available CSG ID(s) together with their "HNB name" (if broadcast) and PLMN(s) to the NAS. The search for available CSGs may be stopped on request of the NAS.

If NAS has selected a CSG and provided this selection to AS, the UE shall search for an acceptable or suitable cell belonging to the selected CSG to camp on.

5.5.2 UTRA case

Support for manual CSG selection in UTRA is described in TS 25.304 [8].

5.6   RAN-assisted WLAN interworking

The purpose of this procedure is to facilitate RAN-assisted WLAN interworking.

5.6.1   RAN assistance parameter handling in RRC_IDLE

RAN assistance parameters may be provided to the UE in *SystemInformationBlockType17* or in the *RRCConnectionReconfiguration* message. RAN assistance parameters are used only if the UE is camped normally.

5.6.2   Access network selection and traffic steering rules

The rules in this clause are only applicable for WLANs for which identifiers has been signaled to the UE by E-UTRAN and the UE is capable of RAN-assisted WLAN interworking based on access network selection and traffic steering rules. Coexistence with ANDSF based WLAN selection and traffic steering methods on the UE is based on mechanism described in TS 23.402 [25]. The rules refer to the following quantities:

ChannelUtilizationWLAN	WLAN channel utilization as defined in clause 8.4.2.30 in [26].
BackhaulRateDlWLAN	WLAN DLBandwidth as defined in clause 9.1.2 in [27].
BackhaulRateUlWLAN	WLAN ULBandwidth as defined in clause 9.1.2 in [27].
WLANRSSI	WLAN RSSI as defined in TS 36.214 [7].
RSRPmeas	Qrxlevmeas in RRC_IDLE, and PCell RSRP in RRC_CONNECTED as defined in TS 36.331 TS 36.331 [3].
RSRQmeas	Qqualmeas in RRC_IDLE, and PCell RSRQ in RRC_CONNECTED as defined in TS 36.331 TS 36.331 [3].

The upper layers in the UE shall be notified (see TS 24.302 [28]) when and for which WLAN(s), that matches all the provided identifiers (in clause 5.6.3) for a specific entry in the list, the following conditions 1 and 2 for steering traffic from E-UTRAN to WLAN are satisfied for a time interval $Tsteering_{WLAN}$:

1. In the E-UTRAN serving cell:

    - $RSRPmeas < Thresh_{ServingOffloadWLAN, LowP}$; or

    - $RSRQmeas < Thresh_{ServingOffloadWLAN, LowQ}$;

2. In the target WLAN:

    - $ChannelUtilizationWLAN < Thresh_{ChUtilWLAN, Low}$; and

    - $BackhaulRateDlWLAN > Thresh_{BackhRateDLWLAN, High}$; and

    - $BackhaulRateUlWLAN > Thresh_{BackhRateULWLAN, High}$; and

    - $WLANRSSI > Thresh_{WLANRSSI, High}$;

The UE shall not consider the metrics for which a threshold has not been provided. The UE shall evaluate the E-UTRAN conditions on PCell only. If not all metrics related to the provided thresholds can be acquired for a WLAN BSS, the UE shall exclude that WLAN BSS from the evaluation of the above rule.

The upper layers in the UE shall be notified (see TS 24.302 [28]) when the following conditions 3 or 4 for steering traffic from WLAN to E-UTRAN are satisfied for a time interval $\text{Tsteering}_{\text{WLAN}}$:

1. In the source WLAN:

   - $\text{ChannelUtilizationWLAN} > \text{Thresh}_{\text{ChUtilWLAN, High}}$; or

   - $\text{BackhaulRateDlWLAN} < \text{Thresh}_{\text{BackhRateDLWLAN, Low}}$; or

   - $\text{BackhaulRateUlWLAN} < \text{Thresh}_{\text{BackhRateULWLAN, Low}}$; or

   - $\text{WLANRSSI} < \text{Thresh}_{\text{WLANRSSI, Low}}$;

2. In the target E-UTRAN cell:

   - $\text{RSRPmeas} > \text{Thresh}_{\text{ServingOffloadWLAN, HighP}}$; and

   - $\text{RSRQmeas} > \text{Thresh}_{\text{ServingOffloadWLAN, HighQ}}$;

The UE shall not consider the metrics for which a threshold has not been provided. The UE shall evaluate the E-UTRAN conditions on PCell only.

5.6.3   RAN assistance parameters definition

The following RAN assistance parameters for RAN-assisted WLAN interworking may be provided:

$\text{Thresh}_{\text{ServingOffloadWLAN, LowP}}$

This specifies the RSRP threshold (in dBm) used by the UE for traffic steering to from E-UTRAN to WLAN.

$\text{Thresh}_{\text{ServingOffloadWLAN, HighP}}$

This specifies the RSRP threshold (in dBm) used by the UE for traffic steering from WLAN to E-UTRAN.

$\text{Thresh}_{\text{ServingOffloadWLAN, LowQ}}$

This specifies the RSRQ threshold (in dB) used by the UE for traffic steering from E-UTRAN to WLAN.

$\text{Thresh}_{\text{ServingOffloadWLAN, HighQ}}$

This specifies the RSRQ threshold (in dB) used by the UE for traffic steering from WLAN to E-UTRAN.

$\text{Thresh}_{\text{ChUtilWLAN, Low}}$

This specifies the WLAN channel utilization (BSS load) threshold used by the UE for traffic steering from E-UTRAN to WLAN.

$\text{Thresh}_{\text{ChUtilWLAN, High}}$

This specifies the WLAN channel utilization (BSS load) threshold used by the UE for traffic steering from WLAN to E-UTRAN.

$\text{Thresh}_{\text{BackhRateDLWLAN, Low}}$

This specifies the backhaul available downlink bandwidth threshold used by the UE for traffic steering from WLAN to E-UTRAN.

$\text{Thresh}_{\text{BackhRateDLWLAN, High}}$

This specifies the backhaul available downlink bandwidth threshold used by the UE for traffic steering from E-UTRAN to WLAN.

$\text{Thresh}_{\text{BackhRateULWLAN, Low}}$

This specifies the backhaul available uplink bandwidth threshold used by the UE for traffic steering from WLAN to E-UTRAN.

Thresh_{BackhRateULWLAN, High}

This specifies the backhaul available uplink bandwidth threshold used by the UE for traffic steering from E-UTRAN to WLAN.

Thresh_{WLANRSSI, Low}

This specifies the WLAN RSSI threshold used by the UE for traffic steering from WLAN to E-UTRAN.

Thresh_{WLANRSSI, High}

This specifies the Beacon RSSI threshold used by the UE for traffic steering from E-UTRAN to WLAN.

Tsteering_{WLAN}

This specifies the timer value Tsteering_{WLAN} during which the rules should be fulfilled before starting traffic steering between E-UTRAN and WLAN.

WLAN identifiers

Only the SSIDs, BSSIDs and HESSIDs which are provided in this parameter shall be considered for traffic steering between E-UTRAN and WLAN based on the rules in this clause.

6 Reception of broadcast information

6.1 Reception of system information

The NAS is informed if the cell selection and reselection results in changes in the received NAS system information.

The UE shall monitor the Paging Occasions (POs) as described in chapter 7.1 to receive System Information change notifications in RRC_IDLE. Changes in the system information are indicated by the network using a *Paging* message or Direct Indication information on MPDCCH and NPDCCH respectively. When the *Paging* message or Direct Indication information indicates system information changes then the UE shall re-acquire the concerned system information, as specified in TS 36.331 [3].

6.2 Reception of MBMS

A UE, except for BL UE or UE in enhanced coverage or NB-IoT UE, interested to receive MBMS services provided using MBSFN transmission shall apply the MCCH information acquision procedure as specified in TS 36.331 [3] to receive the MCCH information upon entering the corresponding MBSFN area and upon receiving a notification that the MCCH information has changed. A UE interested to receive MBMS services provided using MBSFN transmission identifies if a service that it is interested to receive is started or ongoing by receiving the MCCH information, and then receives a MTCH corresponding to the identified service.

A UE interested to receive MBMS services provided using SC-PTM transmission shall apply the SC-MCCH information acquisition procedure as specified in TS 36.331 [3] to receive the SC-MCCH information upon entering a new cell and upon receiving a notification that the SC-MCCH information has changed. A UE interested to receive MBMS services provided using SC-PTM transmission identifies if a service that it is interested to receive is started or ongoing by receiving the SC-MCCH information, and then receives a SC-MTCH configured using the SC-MRB establishment procedure in TS 36.331 [3] and using the DL-SCH reception and SC-PTM DRX procedure as specified in TS 36.321 [30].

For BL UE or UE in enhanced coverage or NB-IoT UE interested to receive MBMS services provided using SC-PTM transmission, in case of conflict, reception of paging or establishment of a RRC connection for Mobile Terminated Call and Mobile Originated Signalling takes precedence over SC-PTM reception.

7   Paging

7.1   Discontinuous Reception for paging

The UE may use Discontinuous Reception (DRX) in idle mode in order to reduce power consumption. One Paging Occasion (PO) is a subframe where there may be P-RNTI transmitted on PDCCH or MPDCCH or, for NB-IoT on NPDCCH addressing the paging message. In P-RNTI transmitted on MPDCCH case, PO refers to the starting subframe of MPDCCH repetitions. In case of P-RNTI transmitted on NPDCCH, PO refers to the starting subframe of NPDCCH repetitions unless subframe determined by PO is not a valid NB-IoT downlink subframe then the first valid NB-IoT downlink subframe after PO is the starting subframe of the NPDCCH repetitions. The paging message is same for both RAN initiated paging and CN initiated paging.

The UE initiates RRC Connection Resume procedure upon receiving RAN paging. If the UE receives a CN initiated paging in RRC_INACTIVE state, the UE moves to RRC_IDLE and informs NAS.

One Paging Frame (PF) is one Radio Frame, which may contain one or multiple Paging Occasion(s). When DRX is used the UE needs only to monitor one PO per DRX cycle.

One Paging Narrowband (PNB) is one narrowband, on which the UE performs the paging message reception.

PF, PO, and PNB are determined by following formulae using the DRX parameters provided in System Information:

PF is given by following equation:

$$SFN \bmod T = (T \text{ div } N)*(UE\_ID \bmod N)$$

Index i_s pointing to PO from subframe pattern defined in 7.2 will be derived from following calculation:

$$i\_s = floor(UE\_ID/N) \bmod Ns$$

If P-RNTI is monitored on MPDCCH, the PNB is determined by the following equation:

$$PNB = floor(UE\_ID/(N*Ns)) \bmod Nn$$

If P-RNTI is monitored on NPDCCH and the UE supports paging on a non-anchor carrier, and if paging configuration for non-anchor carrier is provided in system information, then the paging carrier is determined by the paging carrier with smallest index n ($0 \le n \le Nn-1$) fulfilling the following equation:

$$floor(UE\_ID/(N*Ns)) \bmod W < W(0) + W(1) + … + W(n)$$

System Information DRX parameters stored in the UE shall be updated locally in the UE whenever the DRX parameter values are changed in SI. If the UE has no IMSI, for instance when making an emergency call without USIM, the UE shall use as default identity UE_ID = 0 in the PF, i_s, and PNB formulas above. If the UE has no 5G-S-TMSI, for instance when the UE has not yet registered onto the network, the UE shall use as default identity UE_ID = 0 in the PF and i_s formulas above.

The following Parameters are used for the calculation of the PF, i_s, PNB, and the NB-IoT paging carrier:

-    T: DRX cycle of the UE.

     Except for NB-IoT: If a UE specific extended DRX value of 512 radio frames is configured by upper layers according to 7.3, T =512. Otherwise, T is determined by the shortest of the UE specific DRX value, if allocated by upper layers, and a default DRX value broadcast in system information. If UE specific DRX is not configured by upper layers, the default value is applied. In RRC_INACTIVE state, if extended DRX is not configured by upper layers as defined in 7.3, T is determined by the shortest of the RAN paging cycle, the UE specific paging cycle, and the default paging cycle, if allocated by upper layers. Otherwise, in RRC_INACTIVE state when extended DRX is configured by upper layers, T is determined by the shortest of the RAN paging cycle, the UE specific paging cycle, if allocated by upper layers and the default paging cycle during the PTW as defined in 7.3, and by the RAN paging cycle outside the PTW.

     For NB-IoT: If UE specific DRX value is allocated by upper layers and minimum UE specific DRX value is broadcast in system information, T = min (default DRX value, max (UE specific DRX value, minimum UE specific DRX value broadcast in system information)). If UE specific DRX is not configured by upper layers or

if the minimum UE specific DRX value is not broadcast in system information, the default DRX value is applied.

- nB: 4T, 2T, T, T/2, T/4, T/8, T/16, T/32, T/64, T/128, and T/256, and for NB-IoT also T/512, and T/1024.

- N: min(T,nB)

- Ns: max(1,nB/T)

- Nn: number of paging narrowbands (for P-RNTI monitored on MPDCCH) or paging carriers (for P-RNTI monitored on NPDCCH) determined as follows:

    If UE monitors GWUS according to clause 7.5.1:

        this is the number of paging narrowbands (paging carriers) that are configured with GWUS.

    else:

        this is the number of paging narrowbands (paging carriers) provided in system information.

- UE_ID:

    If the UE supports E-UTRA connected to 5GC and NAS indicated to use 5GC for the selected cell:

        5G-S-TMSI mod 1024, if P-RNTI is monitored on PDCCH.

        5G-S-TMSI mod 16384, if P-RNTI is monitored on NPDCCH or MPDCCH.

    else

        IMSI mod 1024, if P-RNTI is monitored on PDCCH.

        IMSI mod 4096, if P-RNTI is monitored on NPDCCH.

        IMSI mod 16384, if P-RNTI is monitored on MPDCCH or if P-RNTI is monitored on NPDCCH and the UE supports paging on a non-anchor carrier, and if paging configuration for non-anchor carrier is provided in system information.

- W(i): Weight for NB-IoT paging carrier i.

- W: Total weight of all NB-IoT paging carriers, i.e. W = W(0) + W(1) + … + W(Nn-1). If UE monitors GWUS according to clause 7.5.1, Total weight of all NB-IoT paging carriers configured with GWUS.

IMSI is given as sequence of digits of type Integer (0..9), IMSI shall in the formulae above be interpreted as a decimal integer number, where the first digit given in the sequence represents the highest order digit.

For example:

$$\text{IMSI} = 12 \text{ (digit1=1, digit2=2)}$$

In the calculations, this shall be interpreted as the decimal integer "12", not "1x16+2 = 18".

5G-S-TMSI is a 48 bit long bit string as defined in TS 23.501 [39]. 5G-S-TMSI shall in the PF and i_s formulae above be interpreted as a binary number where the left most bit represents the most significant bit.

7.2   Subframe Patterns

FDD:

- If P-RNTI is transmitted on PDCCH or NPDCCH, or if P-RNTI is transmitted on MPDCCH with system bandwidth > 3MHz:

Ns	PO when i_s=0	PO when i_s=1	PO when i_s=2	PO when i_s=3
1	9	N/A	N/A	N/A
2	4	9	N/A	N/A
4	0	4	5	9

- If P-RNTI is transmitted on MPDCCH with system bandwidth of 1.4MHz and 3MHz:

Ns	PO when i_s=0	PO when i_s=1	PO when i_s=2	PO when i_s=3
1	5	N/A	N/A	N/A
2	5	5	N/A	N/A
4	5	5	5	5

TDD (all UL/DL configurations):

- If P-RNTI is transmitted on PDCCH or NPDCCH, or if P-RNTI is transmitted on MPDCCH with system bandwidth > 3MHz:

Ns	PO when i_s=0	PO when i_s=1	PO when i_s=2	PO when i_s=3
1	0	N/A	N/A	N/A
2	0	5	N/A	N/A
4	0	1	5	6

- If P-RNTI is transmitted on MPDCCH with system bandwidth of 1.4MHz and 3MHz:

Ns	PO when i_s=0	PO when i_s=1	PO when i_s=2	PO when i_s=3
1	1	N/A	N/A	N/A
2	1	6	N/A	N/A
4	1	1	6	6

7.3 Paging in extended DRX

The UE may be configured by upper layers with an extended DRX (eDRX) cycle T_{eDRX}. Except for NB-IoT, the UE may operate in extended DRX only if the UE is configured by upper layers and the cell indicates support for eDRX in System Information. For NB-IoT, the UE may operate in extended DRX only if the UE is configured by upper layers. If the UE is configured with a T_{eDRX} cycle of 512 radio frames, it monitors POs as defined in 7.1 with parameter T = 512. Otherwise, a UE configured with eDRX monitors POs as defined in 7.1 (i.e, based on the upper layer configured DRX value and a default DRX value determined in 7.1 or if the UE is in RRC-INACTIVE based on the upper layer configured DRX value,default DRX cycle and RAN paging cycle determined in 7.1), during a periodic Paging Time Window (PTW) configured for the UE or until a paging message including the UE's NAS identity is received for the UE during the PTW, whichever is earlier. The PTW is UE-specific and is determined by a Paging Hyperframe (PH), a starting position within the PH (PTW_start) and an ending position (PTW_end). PH, PTW_start and PTW_end are given by the following formulae:

The PH is the H-SFN satisfying the following equation:

H-SFN mod $T_{eDRX,H}$= (UE_ID_H mod $T_{eDRX,H}$), where

- UE_ID_H:

  - 10 most significant bits of the Hashed ID, if P-RNTI is monitored on PDCCH or MPDCCH

  - 12 most significant bits of the Hashed ID, if P-RNTI is monitored on NPDCCH

- $T_{eDRX,H}$: eDRX cycle of the UE in Hyper-frames, ($T_{eDRX,H}$ =1, 2, …, 256 Hyper-frames) (for NB-IoT, $T_{eDRX,H}$ =2, …, 1024 Hyper-frames) and configured by upper layers.

PTW_start denotes the first radio frame of the PH that is part of the PTW and has SFN satisfying the following equation:

SFN = 256* i_{eDRX}, where

- i_{eDRX} = floor(UE_ID_H /$T_{eDRX,H}$) mod 4

PTW_end is the last radio frame of the PTW and has SFN satisfying the following equation:

SFN = (PTW_start + L*100 - 1) mod 1024, where

- L = Paging Time Window length (in seconds) configured by upper layers

Hashed ID is defined as follows:

Hashed_ID is Frame Check Sequence (FCS) for the bits b31, b30…, b0 of S-TMSI or 5G-S-TMSI. 5G-S-TMSI is used for Hashed-ID if the UE supports connection to 5GC and NAS indicated to use 5GC for the selected cell.

S-TMSI = <b39, b38, …, b0> as defined in TS 23.003 [35]

5G-S-TMSI = <b47, b46, …, b0> as defined in TS 23.003 [35].

The 32-bit FCS shall be the ones complement of the sum (modulo 2) of Y1 and Y2, where

- Y1 is the remainder of x^k ($x^{31} + x^{30} + x^{29} + x^{28} + x^{27} + x^{26} + x^{25} + x^{24} + x^{23} + x^{22} + x^{21} + x^{20} + x^{19} + x^{18} + x^{17} + x^{16} + x^{15} + x^{14} + x^{13} + x^{12} + x^{11} + x^{10} + x^9 + x^8 + x^7 + x^6 + x^5 + x^4 + x^3 + x^2 + x^1 + 1$) divided (modulo 2) by the generator polynomial $x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^8 + x^7 + x^5 + x^4 + x^2 + x + 1$, where k is 32; and

- Y2 is the remainder of Y3 divided (modulo 2) by the generator polynomial $x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^8 + x^7 + x^5 + x^4 + x^2 + x + 1$, where Y3 is the product of x^{32} by "b31, b30…, b0 of S-TMSI or 5G-S-TMSI", i.e., Y3 is the generator polynomial x^{32} ($b31*x^{31} + b30*x^{30} + … + b0*1$).

NOTE: The Y1 is 0xC704DD7B for any S-TMSI or 5G-S-TMSI value. An example of hashed ID calculation is in Annex B.

7.4 Paging with Wake Up Signal

Paging with Wake Up Signal is only used in the cell in which the UE most recently entered RRC_IDLE triggered by:

- reception of *RRCEarlyDataComplete*; or

- reception of *RRCConnectionRelease* not including *noLastCellUpdate*; or

- reception of *RRCConnectionRelease* including *noLastCellUpdate* and the UE was using WUS in this cell prior to this RRC connection attempt.

If the UE is in RRC_IDLE, the UE is not using GWUS according to clause 7.5 and the UE supports WUS and WUS configuration is provided in system information, the UE shall monitor WUS using the WUS parameters provided in System Information. When DRX is used and the UE detects WUS the UE shall monitor the following PO. When extended DRX is used and the UE detects WUS the UE shall monitor the following *numPOs* POs or until a paging message including the UE's NAS identity is received, whichever is earlier. If the UE does not detect WUS the UE is not required to monitor the following PO(s). If the UE missed a WUS occasion (e.g. due to cell reselection), it monitors every PO until the start of next WUS or until the PTW ends, whichever is earlier.

- *numPOs* = Number of consecutive Paging Occasions (PO) mapped to one WUS provided in system information where (*numPOs*≥1).

The WUS configuration, provided in system information, includes time-offset between end of WUS and start of the first PO of the *numPOs* POs UE is required to monitor. The timeoffset in subframes, used to calculate the start of a subframe *g*0 (see TS 36.213 [6]), is defined as follows:

- for UE using DRX, it is the signalled *timeoffsetDRX*;

- for UE using eDRX, it is the signalled *timeoffset-eDRX-Short* if *timeoffset-eDRX-Long* is not broadcasted;

- for UE using eDRX, it is the value determined according to Table 7.4-1 if *timeoffset-eDRX-Long* is broadcasted

Table 7.4-1: Determination of GAP between end of WUS and associated PO

		timeoffset-eDRX-Long	
		1000ms	*2000ms*
UE Reported wakeUpSignalMinGap-eDRX	**40ms or not reported**	*timeoffset-eDRX-Short*	*timeoffset-eDRX-Short*
	240ms	*timeoffset-eDRX-Short*	*timeoffset-eDRX-Short*
	1000ms	*timeoffset-eDRX-Long*	*timeoffset-eDRX-Long*
	2000ms	*timeoffset-eDRX-Short*	*timeoffset-eDRX-Long*

The timeoffset is used to determine the actual subframe $g0$ as follows (taking into consideration resultant SFN and/or H-SFN wrap-around of this computation):

$g0$ = PO – timeoffset, where PO is the Paging Occasion subframe as defined in clause 7.1

For UE using eDRX, the same timeoffset applies between the end of WUS and associated first PO of the *numPOs* POs for all the WUS occurrences for a PTW.

The timeoffset, $g0$, is used to calculate the start of the WUS as defined in TS 36.213 [6].

7.5   Paging with Group Wake Up Signal

7.5.1   General

Paging with Group Wake Up Signal is only used in the cell in which the UE most recently entered RRC_IDLE triggered by:

-    reception of *RRCEarlyDataComplete*; or

-    reception of *RRCConnectionRelease* not including *noLastCellUpdate*; or

-    reception of *RRCConnectionRelease* including *noLastCellUpdate* and the UE was using WUS in this cell prior to this RRC connection attempt.

When all of the following conditions are met then the UE shall monitor GWUS using the GWUS parameters provided in system information:

-    the UE is in RRC_IDLE;

-    the UE supports GWUS;

-    GWUS configuration (*gwus-Config*) is provided in system information;

-    *groupAlternation* is present in g*wus-Config* and UE supports GWUS with group resource alternation; or

-    *groupAlternation* is not present in *gwus-Config*.

A UE supporting GWUS can be configured to monitor a WUS group and a common WUS. Upon detecting either of them, UE shall monitor POs as defined in clause 7.4.

For NB-IoT, E-UTRAN may configure up to 2 WUS resources (numbered 0 and 1). The timeoffset, $g0$, from the end of WUS resource 0 to the start of corresponding PO is determined as defined in clause 7.4. When both *wus-Config* and g*wus-Config* are present, WUS resource 0 shares radio resources with *wus-Config*.The timeoffset from the end of WUS resource 1 to the start of corresponding PO is sum of the timeoffset $g0$ and the maximum WUS duration.

After the UE has determined the applicable gap between end of WUS resource and associated PO as specified in clause 7.4, UE selects the WUS group set for the corresponding gap as specified in clause 7.5.2. From the selected WUS group

set, UE selects one WUS group as defined in clause 7.5.3. If *groupAlternation* is not present in *gwus-Config*, the UE monitors the selected WUS group with the corresponding timeoffset for each PO. If *groupAlternation* is present in *gwus-Config* and UE supports GWUS with group resource alternation, the UE determines the WUS group to monitor for each PO and the corresponding timeoffset as specified in clause 7.5.4.

For BL UEs and UEs in enhanced coverage, E-UTRAN may configure up to 4 WUS resources. The resource number, time and frequency location of these resources is determined as specified in clause 7.5.5.

7.5.2　WUS group sets selection

The total number of WUS groups, maxWG, configured for a gap is determined with the following equation:

$$\text{maxWG} = \sum_{i=0}^{maxWR-1} numGroupsList[i]$$

where:

- *maxWR* is the total number of WUS resources configured for the gap.

- *numGroupsList[i]* is the number of WUS groups configured for WUS resource i, provided in *gwus-Config,* for the gap.

Using *numGroupsList* for the gap*,* the UE builds the list of WUS groups as an ordered list of pairs ($N_{ID}^{resource}$, N_{group}^{WUS}) where the first entry corresponds to the first WUS group on the first configured WUS resource and the last entry corresponds to the last WUS group on the last configured WUS resource.

For a NB-IoT UE, if *resourcePosition* provided in *gwus-Config* is set to *secondary,* $N_{ID}^{resource} = 0$ is not used and the first entry in the list corresponds to $N_{ID}^{resource} = 1$. Otherwise, $N_{ID}^{resource}$ is the index of the WUS resources in *numGroupsList*.

For a BL UE or UE in enhanced coverage, UE determines $N_{ID}^{resource}$ of the configured resources as specified in clause 7.5.4.

If *probThreshList* is present in *gwus-Config*, the UE determines the WUS group sets as defined in Table 7.5.2.1. The total number of WUS group sets is equal to the number of entries in *probThreshList* + 1. The WUS groups are first assigned to WUS group set 1, followed by WUS group set 2, and so on. The UE determines the WUS group set corresponding to its probability P_{NAS}, if configured, as defined in Table 7.5.2-1. If P_{NAS} is not configured, the UE selects the WUS group set with the index equal to the number of entries in *probThreshList* + 1.

Table 7.5.2-1: WUS group set definition when *probThreshList* is configured

WUS group set	probThreshList	WUS group index in WUS groups list	
		Lower bound	Upper bound
1	$P_{NAS} \leq Thresh_1$	0	N_{th1} - 1
2	$Thresh_1 < P_{NAS} \leq Thresh_2$ (Note)	N_{th1}	$N_{th1} + N_{th2}$ - 1
3	$Thresh_2 < P_{NAS} \leq Thresh_3$ (Note)	$N_{th1} + N_{th2}$	$N_{th1} + N_{th2} + N_{th3}$ - 1
4	$P_{NAS} > Thresh_3$	$N_{th1} + N_{th2} + N_{th3}$	maxWG - 1
where	$Thresh_i$ is the value signalled in the ith entry of *probThreshList* N_{thi} is the value signalled in the ith entry of *groupsForServiceList*		
Note:	When the total number of WUS group sets is less than 4, the upper bound for the WUS group set with highest index is maxWG - 1.		

If *probThreshList* is not present in *gwus-Config*, there is only one WUS group set containing all the WUS groups configured in *numGroupsList*. The total number of WUS groups is maxWG.

7.5.3　WUS group selection

After selection of the WUS group set as specified in clause 7.5.2, the UE selects the WUS group to monitor as below.

For BL UE or UE in enhanced coverage, the UE determines wg with following equation:

$$wg = floor\left(floor\left(\frac{UE\_ID}{N \times N_s}\right)/N_n\right) mod\ N_w$$

For NB-IoT, the UE determines wg with following equation:

$$wg = floor\left(\frac{UE\_ID}{N \times N_s \times W}\right) mod\ N_w$$

where:

- UE_ID, N, N_s, N_n and W are defined in clause 7.1.

- N_w is the number of WUS groups in the selected WUS group set.

- wg is the index of the WUS group in the selected WUS group set, determined as defined in clause 7.5.2, 0 .. N_w-1.

If *probThreshList* is not present, WG = wg. If *probThreshList* is present, the UE determines WG, the index of the corresponding WUS group within the WUS groups list, as defined in Table 7.5.3-1.

Table 7.5.3-1: Index of the WUS group to monitor

Selected WUS group set	WG
1	wg
2	wg + N_{th1}
3	wg + N_{th1} + N_{th2}
4	wg + N_{th1} + N_{th2} + N_{th3}
Where N_{thi} is defined in table 7.5.1	

The entry corresponding to WG in the WUS groups list defined in clause 7.5.2 provides ($N_{ID}^{resource}$, N_{group}^{WUS}) as specified in TS 36.213 [6].

7.5.4   WUS Group Alternation

If *groupAlternation* is present in *gwus-Config,* the UE determines the WUS group to monitor for the current PO as follows:

- if *probThreshList* is not present in *gwus-Config* and *commonSequence* is set to *g0*:

$$WG_{current} = \left(WG_{initial} +\ G_{min} \cdot floor\left(\frac{SFN + 1024 * H\text{-}SFN}{Tcell}\right)\right) mod\ maxWG$$

where:

- T_{cell} is the default DRX cycle for the cell.

- SFN is the SFN corresponding to the PO.

- H-SFN is the H-SFN corresponding to the PO.

- maxWG is the total number of WUS groups configured in *numGroupsList* for the gap.

- G_{min} is the lowest number of WUS groups configured amongst all WUS resources for the gap.

- $WG_{current}$ is the index of the WUS group to monitor for the current PO.

- $WG_{initial}$ is the index, WG, of the WUS group determined in clause 7.5.3.

The entry corresponding to $WG_{current}$ in the WUS groups list defined in clause 7.5.2 provides ($N_{ID}^{resource}$, N_{group}^{WUS}) as specified in TS 36.213 [6].

- else:

$$m_{current} = \left(m_{initial} + floor \left(\frac{SFN + 1024 * H\text{-}SFN}{Tcell} \right) \right) \bmod maxWR$$

where:

- T_{cell} is the default DRX cycle for the cell.

- SFN is the SFN corresponding to the PO.

- H-SFN is the H-SFN corresponding to the PO.

- maxWR is the total number of WUS resources configured in *numGroupsList* for the gap.

- $m_{initial}$ is defined based on $N_{ID}^{resource}$ given in the entry corresponding to the index WG determined in clause 7.5.3:

    - For a NB-IoT UE : $m_{initial} = N_{ID}^{resource}$

    - For a BL UE or UE in enhanced coverage:

        - if $N_{ID}^{resource} = 0$ is used for GWUS:

            - $m_{initial} = N_{ID}^{resource}$ - 1

        - else:

            - $m_{initial} = N_{ID}^{resource}$

- $m_{current}$ is used to determine $N_{ID}^{resource}$ of the WUS group to monitor for the current PO as follows:

    - For a NB-IoT UE : $N_{ID}^{resource} = m_{current}$.

    - For a BL UE or UE in enhanced coverage:

        - if $N_{ID}^{resource} = 0$ is used for GWUS:

            - $N_{ID}^{resource} = m_{current}$

        - else:

            - $N_{ID}^{resource} = m_{current} + 1$

N_{group}^{WUS} of the WUS group to monitor for the current PO is given in the entry corresponding to the index WG determined in clause 7.5.3.

7.5.5 WUS Resource Location for BL UEs and UEs in Enhanced coverage

A BL UE or UE in enhanced coverage determines the time/frequency location of WUS resources based on the number of configured WUS resources and the frequency location of WUS resource 0 ($N_{ID}^{resource} = 0$). If *wus-Config* is present, frequency location for WUS resource 0 is defined by *frequencyLocation* parameter in *wus-Config*. Otherwise, frequency location for WUS resource 0 is defined by *resourceLocationWithoutWUS* in *gwus-Config*. The frequency location of other WUS resources (i.e., WUS resource 1, 2, 3), based on frequency location of WUS resource 0, is given in Table 7.5.5-1.

Table 7.5.5-1: WUS resource frequency location

WUS resource ($N_{\mathrm{ID}}^{\mathrm{resource}}$)	Frequency location of WUS resource ID 0			
	n0	n2		n4 (NOTE 1)
		NB frequency < centre frequency	NB frequency > centre frequency	
WUS resource 1,3	n2	n4	n0	n2
WUS resource 2	n0	n2	n2	n4
WUS resource 2 (NOTE 2)	n4	n0	n4	n0
NOTE 1: This column is applicable if *wus-Config* is present.				
NOTE 2: This row is applicable if *resourceLocationWithWUS* is *primary3FDM*.				

The timeoffset, *g*0, from the end of WUS resource 0 and WUS resource 1 to the start of corresponding PO is determined as defined in clause 7.4. Except when *resourceLocationWithWUS* is set to *primary3FDM* , the timeoffset from the end of WUS resource 2 and WUS resource 3 to the start of corresponding PO is sum of the timeoffset *g*0 and the maximum WUS duration. When *resourceLocationWithWUS* is set to *primary3FDM*, the timeoffset for WUS resource 2 is same as WUS resource 0 and 1.

The resource pattern ID (rp-ID) which indicates the WUS resources applicable for GWUS is derived based on *resourceMappingPattern* and the configured number of WUS resources as follows:

If *resourceLocationWithWUS* is configured:

rp-ID = 2*(maxWR - 1) if *resourceLocationWithWUS* is set to *primary.*

rp-ID = 2*maxWR - 1 if *resourceLocationWithWUS* is set to *secondary.*

rp-ID = 7 if *resourceLocationWithWUS* is set to *primary3FDM*.

If *resourceLocationWithoutWUS* is configured:

rp-ID = 2*(maxWR - 1)

where maxWR is the total number of WUS resources configured in *numGroupsList* for the gap.

The WUS resource IDs corresponding to the resource pattern ID are determined as defined in Table 7.5.5-2.

Table 7.5.5-2: WUS resources applicable for Resource Pattern

WUS resource ($N_{\mathrm{ID}}^{\mathrm{resource}}$)	Resource Pattern ID							
	0	1	2	3	4	5	6	7
0	X		X		X		X	X
1		X	X	X	X	X	X	X
2				X	X	X	X	X
3						X	X	

If $N_{\mathrm{ID}}^{\mathrm{resource}} = 0$ is not used, the first entry in the *numGroupsList* corresponds to $N_{\mathrm{ID}}^{\mathrm{resource}} = 1$. Otherwise, $N_{\mathrm{ID}}^{\mathrm{resource}}$ is the index of the WUS resources in *numGroupsList*.

7.6 NRS presence on non-anchor paging carrier in NB-IoT

For FDD, when *nrs-NonAnchorConfig* is signalled in system information, the POs with associated NRS are determined using the DRX parameters broadcast in *systeminformationBlockType2-NB*:

- T is the value of *defaultPagingCycle* broadcast in system information.

- nB is the value corresponding to *nB* broadcast in system information: 4T, 2T, T, T/2, T/4, T/8, T/16, T/32, T/64, T/128, T/256, T/512, and T/1024.

The POs are determined by:

- Paging Frame (PF) given by: SFN mod T= (T div N) * k

    where:

    - N: min(T, nB)

    - k: 0, 1, .., N-1

- Paging subframe given by index i_s

    where:

    - Index i_s: values pointing to a subframe for which a PO is defined in the row referenced by Ns in clause 7.2.

    - Ns: max(1, nB/T)

The POs with associated NRS are determined as follows:

- if nB is equal to 4T, 2T, T or T/2:

    POs for which R = 1 have associated NRS

    where:

        R = (PO_Index+ Offset) mod 2

    where:

    - PO_Index = (SFN * nB/T + i_s) mod nB

    - Offset = (FLOOR ((SFN + 1024*H-SFN) / T)) mod 2

    - SFN is the SFN corresponding to the PO

    - H-SFN is the H-SFN corresponding to the PO

    - i_s is the index i_s corresponding to the PO

- else:

    all POs have associated NRS.

8   Logged measurements

The UE may be configured to perform logging of measurement results in RRC_IDLE mode with the *LoggedMeasurementConfiguration* message as specified in TS 36.331 [3]. This configuration is valid while the logging duration timer is running.

If the configuration of logged measurements is valid, the UE shall perform logging of measurement results if all of the following conditions are met:

- The UE is in *camped normally* state in RRC_IDLE mode;

- The RPLMN of the UE is the same as the RPLMN at the point of time of *LoggedMeasurementConfiguration* message reception, or is present in the *plmn-IdentityList* (see TS 36.331 [3]) if configured;

- The UE is camped on a cell belonging to the *areaConfiguration* (see TS 36.331 [3]), if configured;

- The UE is camped on the RAT where the logged measurement configuration was received;

- The UE receives MBMS service from MBSFN area(s) belonging to *targetMBSFN-AreaList*, if included in the logged measurement configuration;

- The IDC capable UE does not detect the presence of in-device coexistence interference.

If the configuration of logged measurements is valid, but the UE is in *any cell* selection state in RRC_IDLE mode, the UE perform logging of available information (i.e. at least indicator on *any cell selection* state and time stamp).

If the configuration of logged MBSFN measurements is valid, the UE shall perform logging of measurement results in RRC_CONNECTED in addition to RRC_IDLE, as described in TS 36.331 [3].

Otherwise, the logging of measurement results shall be suspended.

NOTE: Even if logging of measurement results is suspended, the logging duration timer and time stamp will continue, and the logged measurement configuration and corresponding log are kept.

9 Accessibility measurements

The UE logs failure information when the RRC connection establishment procedure fails as specified in TS 36.331 [3].

10 Mobility History Information

The UE stores the history of serving cells as specified in TS 36.331[3].

11 Sidelink operation

11.1 Sidelink communication and V2X sidelink communication and NR sidelink communication

The UE may transmit or receive sidelink communication if it fulfils the condition(s) defined in TS 36.331 [3], clause 5.10.1a. The UE may transmit or receive V2X sidelink communication if it fulfils the condition(s) defined in TS 36.331 [3], clause 5.10.1d. When UE is in-coverage for sidelink operation as defined in clause 11.4, the UE may perform the sidelink communication according to *SystemInformationBlockType18* or perform the V2X sidelink communication according to *SystemInformationBlockType21* or *SystemInformationBlockType26,* and when out-of-coverage for sidelink, the UE may perform the sidelink communication according to *SL-Preconfiguration* or perform V2X sidelink communication according to *SL-V2X-Preconfiguration* or according to *SystemInformationBlockType21* or *SystemInformationBlockType26* of the cell on the frequency which provides inter-carrier V2X sidelink configuration, as specified in TS 36.331 [3]. The UE shall not perform V2X sidelink communication according to *SL-V2X-Preconfiguration* if the UE detects a cell providing V2X sidelink configuration or inter-carrier V2X sidelink configuration for the frequency UE is interested to perform V2X sidelink communication on.

The UE may transmit or receive NR sidelink communication if it fulfills the condition(s) defined in TS 38.331 [37], clause 5.8.2. When UE is in-coverage for sidelink operation as defined in clause 11.4, the UE may perform NR sidelink communication according to *SystemInformationBlockType12* of the cell on an E-UTRAN frequency.

11.2 Sidelink discovery

The UE may transmit sidelink discovery if it fulfils the condition(s) defined in TS 36.331 [3], clauses 5.10.1b and 5.10.1c. When UE is in-coverage for sidelink as defined in clause 11.4, the UE may perform the sidelink discovery according to *SystemInformationBlockType19*, and when out-of-coverage for sidelink as defined in clause 11.4, the UE may perform the sidelink discovery according to *SL-Preconfiguration*, as specified in TS 36.331 [3].

NOTE: Sidelink discovery reception in idle mode is up to UE implementation.

11.3 Sidelink synchronisation

The UE may perform sidelink synchronisation according to *SystemInformationBlockType18* for sidelink communication, *SystemInformationBlockType19* for sidelink discovery or *SystemInformationBlockType21* for V2X sidelink communication, as specified in TS 36.331 [3].

11.4 Cell selection and reselection for sidelink

The requirements defined in this clause for sidelink operation apply for UEs in RRC_IDLE and in RRC_CONNECTED.

When UE is interested to perform sidelink communication or sidelink discovery announcement on non-serving frequency, it shall perform measurements on that frequency for cell selection and intra-frequency reselection purpose in accordance with TS 36.133 [10]. When UE is interested to perform V2X sidelink communication on non-serving frequency, it may perform measurements on that frequency or the frequencies which can provide inter-carrier V2X sidelink configuration for that frequency for cell selection and intra-frequency reselection purpose in accordance with TS 36.133 [10]. When UE is interested to perform NR sidelink communication on non-serving frequency, it may perform measurements on that frequency or the frequencies which can provide inter-carrier NR sidelink configuration for that frequency for cell selection and intra-frequency reselection purpose in accordance with TS 36.133[10].

If the UE detects at least one cell on the frequency which UE is configured to perform sidelink operation on fulfilling the S criterion in accordance with clause 11.4.1, it shall consider itself to be in-coverage for sidelink operation on that frequency. If the UE cannot detect any cell on that frequency meeting the S criterion, it shall consider itself to be out-of-coverage for sidelink operation on that frequency.

If the UE detects at least one cell on the frequency which UE is configured to perform NR sidelink communication on fulfilling the S criterion in accordance with clause 11.4.1, it shall consider itself to be in-coverage for NR sidelink communication on that frequency. If the UE cannot detect any cell on that frequency meeting the S criterion, it shall consider itself to be out-of-coverage for NR sidelink communication on that frequency.

If the UE has selected a cell on a non-serving frequency for sidelink communication or V2X sidelink communication or NR sidelink communication or sidelink discovery announcement, it shall perform additional intra-frequency reselection process to select a better cell for sidelink operation on that frequency in accordance with clause 11.4.1.

NOTE 1: The UE may consider the carrier pre-configured for sidelink communication or V2X sidelink communication, or the frequencies pre-configured for providing inter-carrier V2X sidelink configuration to have the highest cell reselection priority in accordance with clause 5.2.4.1.

NOTE 2: If the frequency the UE is configured to perform sidelink communication on is a serving frequency, the UE uses the serving cell on that frequency for the sidelink operation.

11.4.1 Parameters used for cell selection and reselection triggered for sidelink

When evaluating S criterion or R criterion (ranking), as defined in clause 5.2.3.2 and clause 5.2.4.6 respectively, for cell selection/reselection triggered for sidelink communication or V2X sidelink communication or sidelink discovery announcement or NR sidelink communication on a non-serving frequency, UE shall perform the evaluation as follows:

- if the UE intends to perform sidelink discovery announcement and it is configured with *discCellSelectionInfo* applicable for that frequency as specified in TS 36.331 [3], the UE shall use cell selection/reselection parameters included in the *discCellSelectionInfo* for the evaluation, and for a parameter used in the evaluation but not included in the *discCellSelectionInfo* applicable for that frequency, UE shall apply zero value.

- else, the UE shall use cell selection/reselection parameters broadcast by the concerned cell (i.e. selected cell for the sidelink operation) for the evaluation.

12. General description of UE camping on E-UTRA connected to 5GC

The functions listed below are applicable to UE camping on E-UTRA connected to 5GC:

- RAN paging (only applicable to RRC_INACTIVE state)

- Unified Access Control

The functions listed below are not applicable to UE camping on E-UTRA connected to 5GC:

- 5.5 Support for manual CSG selection

- 5.6 RAN-assisted WLAN interworking

- 6.2 Reception of MBMS

- 7.3 Paging in extended DRX (except for BL UE, UE in enhanced coverage or NB-IoT UE)

- 8 Logged measurements

- 9 Accessibility measurements

- 11 Sidelink operation

Annex A (informative):
Void

Annex B (informative):
Example of Hashed ID Calculation using 32-bit FCS

Inputs:

- Least significant bits of S-TMSI: 0x12341234

- Generator polynomial: 0x104C11DB7 (1 0000 0100 1100 0001 0001 1101 1011 0111)

Procedure to Calculate Hashed ID:

step a)

- k = 32

- numerator: 0xFFFF FFFF 0000 0000

- denominator: 0x1 04C1 1DB7

- remainder Y1 = 0xC704DD7B

step b)

- numerator: 0x1234 1234 0000 0000

- denominator: 0x1 04C1 1DB7

- remainder Y2 = 0x1D66F1A6

Hashed_ID = FCS = ones complement of (remainder Y1 XOR remainder Y2)

= ones complement of (0xC704DD7B XOR 0x1D66F1A6)

= negation of (0xDA622CDD)

= 0x259DD322

Annex C (informative): Change history

Date	TSG #	TSG Doc.	CR	Rev	Cat	Subject/Comment	New version
2007-06						Agreed text proposals from TSG RAN2#58bis meeting	0.0.1
2007-09	RP-37	RP-070687				Presented for information at TSG RAN-37	1.0.0
2007-11	RP-38	RP-070915				Presented for approval at TSG RAN-38	2.0.0
	RP-38	-				Approved at TSG RAN-38 and placed under change control	8.0.0
2008-03	RP-39	RP-080193	0001	1		CR to 36.304 on Miscellaneous corrections	8.1.0
2008-05	RP-40	RP-080408	0002	-		Add RAT specific Treselection parameters for CDMA HRPD and 1xRTT	8.2.0
	RP-40	RP-080408	0003	1		Paging Subframe Patterns for FDD and TDD and paging parameters clarification	8.2.0
	RP-40	RP-080408	0004	1		Editorial corrections to 36.304	8.2.0
	RP-40	RP-080408	0005	-		PLMN selection ping-pong control	8.2.0
2008-09	RP-41	RP-080689	0006	1		CR on Considerations on various open items in 36.304	8.3.0
	RP-41	RP-080689	0007	1		CSG related correction to 36.304	8.3.0
	RP-41	RP-080689	0008	1		Clarification of the medium mobility state criteria	8.3.0
	RP-41	RP-080689	0009	-		Support for Manual CSG ID Selection	8.3.0
	RP-41	RP-080689	0010	-		USIM less paging occasion calculation	8.3.0
	RP-41	RP-080689	0013	1		Definition of Qoffset in cell reselection criteria	8.3.0
	RP-41	RP-080689	0017	-		Correction to Discontinuous Reception for paging	8.3.0
	RP-41	RP-080689	0018	-		Lifetime of dedicated cell reselection priorities	8.3.0
	RP-41	RP-080689	0019	-		Clarification on cell reselection parameters	8.3.0
2008-12	RP-42	RP-081017	0020	1		Correcting the UE behaviour when Sintrasearch and Snonintrasearch are not provided	8.4.0
	RP-42	RP-081017	0021	-		Proposed CR to 36.304 [Rel-8] on Definition of	8.4.0
	RP-42	RP-081017	0022	1		Proposed CR to 36.304 [Rel-8] on Intra-frequency reselection allowed/not-allowed concept	8.4.0
	RP-42	RP-081017	0023	-		Proposed CR to 36.304 [Rel-8] on Introduction of Pcompensation	8.4.0
	RP-42	RP-081017	0024	-		Proposed CR to 36.304 [Rel-8] on Support of UE autonomous search for E-UTRAN CSG cells when camped on other RAT than E-UTRAN	8.4.0
	RP-42	RP-081017	0025	-		Correction to range of nB in TS 36.304	8.4.0
	RP-42	RP-081017	0026	2		Miscellaneous corrections to 36.304	8.4.0
	RP-42	RP-081017	0027	1		Proposed CR to 36.304 [Rel-8] on Support of registration procedures as outcome of a manual CSG ID selection	8.4.0
	RP-42	RP-081017	0029	2		Implicit priority for CSG cells	8.4.0
	RP-42	RP-081017	0032	-		Correction of the reselection formula for offset used for PLMN selection	8.4.0
	RP-42	RP-081017	0036	-		Clarification of definition of SnonServingCell,x for cdma2000 RATs in TS 36.304	8.4.0
	RP-42	RP-081017	0038	1		Support of emergency calls in LTE Rel-8	8.4.0
	RP-42	RP-081017	0042	-		CR to 36.304 on Removal of cellReservationExtension	8.4.0
	RP-42	RP-081017	0044	1		Idle mode agreements related to 36.304	8.4.0
2009-03	RP-43	RP-090125	0045	-		CR to 36.304 on correction of definition of Pmax	8.5.0
	RP-43	RP-090125	0046	1		Emergency call in camped on any cell state in LTE Rel8	8.5.0
	RP-43	RP-090125	0047	-		Handling of Priority of Camping Frequency	8.5.0
	RP-43	RP-090125	0048	2		Correction to implementation of CR0009 to 36.304	8.5.0
	RP-43	RP-090125	0049	-		UE Behaviour on Registration Failure to CSG	8.5.0
	RP-43	RP-090125	0050	2		CR to 36.304 to capture several editorial corrections	8.5.0
	RP-43	RP-090125	0051	1		CR to 36.304 on Update of Figure 4.1-1 Overall Idle Mode Process	8.5.0
	RP-43	RP-090125	0053	2		Correction to priority based reselection handling	8.5.0
	RP-43	RP-090125	0057	3		CR on UE behaviour in absence of reselection priorities in system information	8.5.0
	RP-43	RP-090125	0058	3		Cell reselection for CSG	8.5.0
	RP-43	RP-090125	0060	-		Corrections to Inter-RAT Cell Reselection Criteria	8.5.0
	RP-43	RP-090125	0062	-		Manual selection	8.5.0
	RP-43	RP-090145	0063	1		Reception of ETWS notification without verifying digital signature	8.5.0
	RP-43	RP-090125	0066	-		Draft CR to 36.304 on Inheriting of dedicated priorities at inter-RAT reselection	8.5.0
	RP-43	RP-090125	0067	-		Proposed CR to 36.304 Clarification on applying DRX value	8.5.0
	RP-43	RP-090125	0070	-		Draft CR to 36.304 on Correction to UE behaviour if dedicated cell reselection priority is assigned but frequency is not configured by system information	8.5.0
	RP-43	RP-090125	0071	-		Clarification to the best non-allowed CSG cell	8.5.0
2009-06	RP-44	RP-090510	0072	2		CR on correction of sign in SnonServingCell,x for CDMA2000 RATs	8.6.0
	RP-44	RP-090510	0073			Correction to UE behaviour while 300s frequency barring timer is running	8.6.0
	RP-44	RP-090510	0074	1		Correction to any cell selection procedure	8.6.0
	RP-44	RP-090510	0075	1		Correction to reselection in case IFRI is not allowed	8.6.0

	RP-44	RP-090510	0076	1		Clarification when no candidate cells on serving frequency	8.6.0
	RP-44	RP-090510	0077	1		Clarification of the Priority Handling in CSG Cell	8.6.0
	RP-44	RP-090510	0079	-		Correction to cell selection when leaving RRC connected mode	8.6.0
	RP-44	RP-090510	0080	-		CR for Removing FFS for T3230	8.6.0
	RP-44	RP-090510	0082	-		Correction on the Lower Priority Cell Reselection Rule	8.6.0
	RP-44	RP-090510	0084	-		Clarification on disabling E-UTRA capabilities with a USIM	8.6.0
2009-09	RP-45	RP-090906	0085	-		Clarification on cell status and cell reservations	8.7.0
	RP-45	RP-090906	0089	-		Correction on Cell reserved for operators use	8.7.0
	RP-45	RP-090906	0094	-		clarifications for manual CSG ID selection	8.7.0
2009-09	RP-45	RP-090934	0086	1		Some clarifications on TS 36.304	9.0.0
	RP-45	RP-090926	0091	1		IMS emergency call when UE camps on acceptable cell	9.0.0
	RP-45	RP-090933	0096	-		Reception of CMAS notifications in limited service state	9.0.0
2009-12	RP-46	RP-091314	0098	-		Clarification on Parameters for Cell Selection	9.1.0
	RP-46	RP-091346	0099	-		Clarifications on autonomous search function for CSG	9.1.0
	RP-46	RP-091346	0100	1		Correction of Treselection inconsistency regarding frequency groups	9.1.0
	RP-46	RP-091346	0102	-		CR to 36.304 - Handling of barring in case of priority based reselection	9.1.0
	RP-46	RP-091346	0103	-		Functions supported for the UE "limited service state"	9.1.0
	RP-46	RP-091334	0104	3		UE's behaviour when camping on cell supporting emergency call	9.1.0
	RP-46	RP-091343	0106	2		Stage3 CR for LTE hybrid cell Idle Mode Mobility	9.1.0
	RP-46	RP-091314	0109	-		Correction related to Location Registration in manual CSG ID selection procedure.	9.1.0
	RP-46	RP-091343	0114	-		Access Stratum support for manual CSG selection across PLMN (CR 36.304 Rel-9)	9.1.0
	RP-46	RP-091343	0117	-		Renaming Allowed CSG List (36.304 Rel-9)	9.1.0
	RP-46	RP-091341	0119	-		Proposed CR to 36.304 on Introduction of MBMS	9.1.0
2010-03	RP-47	RP-100296	0122	-		Clarification on RRC connection re-establishment for emergency calls	9.2.0
	RP-47	RP-100308	0123	1		Correction on reselection from non-CSG cell to CSG inter-RAT cell	9.2.0
	RP-47	RP-100308	0124	1		Miscellaneous correction on 36.304	9.2.0
	RP-47	RP-100305	0125	-		Proposed CR to 36.304 on Addition of missing abbreviations related with MBMS	9.2.0
	RP-47	RP-100308	0129	-		Cell reselection enhancements CR for 36.304	9.2.0
2010-06	RP-48	RP-100556	0133	-		Correction to CSG autonomous search function	9.3.0
2010-09	RP-49	RP-100855	0134	-		Clarification on CSG autonomous search	9.4.0
	RP-49	RP-100851	0136	1		Clarifications Regarding Redirection from LTE	9.4.0
	RP-49	RP-100845	0138	-		Correct the PEMAX_H to PEMAX	9.4.0
	RP-49	RP-100851	0139	1		Clarification on the use of RSRQ for cell reselection towards GERAN or CDMA	9.4.0
2010-12	RP-50	RP-101210	0142	-		Cell selection in case of redirection based CSFB procedure	9.5.0
2010-12	RP-50	RP-101221	0140	2		36.304 CR on MDT	10.0.0
2011-03	RP-51	RP-110271	0151	-		36.304 correction on manual CSG selection	10.1.0
2011-06	RP-52	RP-110835	0154	-		CR to align NAS and AS for handling of CSG cells	10.2.0
	RP-52	RP-110843	0155	1		Clean up of MDT clause	10.2.0
2011-09	RP-53	RP-111281	0160	-		Correction of inter-frequency or inter-RAT cell reselection criteria for UTRA TDD case	10.3.0
2011-12	RP-54	RP-111710	0167	1		Clarification of inter-RAT cell reselection enhancements	10.4.0
2012-03	RP-55	RP-120325	0175	-		MBMS Multibands Cell Selection and Reselection	10.5.0
2012-06	RP-56	RP-120813	0183	1		Korean Public Alert System (KPAS) in relation to CMAS	10.6.0
	RP-56	RP-120807	0187	1		Avoiding unexpected UE prioritization for MBMS where MBMS is not deployed	10.6.0
	RP-56	RP-120813	0188	1		EU-Alert in relation to CMAS	11.0.0
2012-09	RP-57	RP-121370	0192	1		Introduction of MDT multi-PLMN	11.1.0
	RP-57	RP-121375	0195	-		Introducing MBMS enhancements	11.1.0
2012-12	RP-58	RP-121940	0196	-		Clarification of MBMS Prioritisation	11.2.0
	RP-58	RP-121957	0197	-		Correction to absolute priority cell reselection	11.2.0
	RP-58	RP-121946	0198	-		Introduction of MDT accessibility measurements	11.2.0
	RP-58	RP-121958	0199	1		RAN overload handling using RRC Reject	11.2.0
2013-03	RP-59	RP-130241	0209	-		Clarification on MBMS Service Continuity	11.3.0
	RP-59	RP-130248	0210	-		Clarification of De-prioritization in idle mode	11.3.0
	RP-59	RP-130247	0213	-		Corrections on mobility to CSG and hybrid cells in idle mode	11.3.0
	RP-59	RP-130248	0214	1		Clarification on handling of deprioritsation information upon PLMN selection	11.3.0
2013-06	RP-60	RP-130808	0221	-		Correction of MBMS prioritisation	11.4.0
	RP-60	RP-130809	0222	-		Updating 3GPP2 specification references	11.4.0
2013-09	RP-61	RP-131311	0223	1		Cell reselection criteria with threshServingLowQ provided	11.5.0
2013-12	RP-62	RP-131987	0227	1		Correction of MBMS prioritisation for DL only carrier	11.6.0
2014-03	RP-63	RP-140359	0233	-		Introduction of UE mobility history reporting (option 2)	12.0.0
2014-06	RP-64	RP-140881	0235	-		Introduction of support for UE power saving mode	12.1.0
	RP-64	RP-140892	0238	1		Introduction of RRC Connection Establishment failure temporary Qoffset handling	12.1.0
2014-09	RP-65	RP-141507	0244	-		Introduction of MBSFN MDT	12.2.0
	RP-65	RP-141504	0243	1		Procedures of WLAN/3GPP Radio Interworking for LTE	12.2.0
2014-12	RP-66	RP-142122	0251	-		Clarification on handling of dedicated parameters upon cell selection	12.3.0

	RP-66	RP-142122	0253	-		UE behavior when the cell temporarily becomes unsuitable.	12.3.0
2015-03	RP-67	RP-150373	0260	-		UE capability signaling for WLAN/3GPP radio interworking	12.4.0
	RP-67	RP-150373	0265	1		Cleanup on RAN-assisted WLAN interworking	12.4.0
	RP-67	RP-150373	0266	-		Correction on WLAN identifiers	12.4.0
	RP-67	RP-150374	0264	1		Introduction of ProSe	12.4.0
2015-06	RP-68	RP-150921	0267	-		Correction on limited service state conditions	12.5.0
	RP-68	RP-150923	0272	1		Correction to SI acquisition failure	12.5.0
2015-09	RP-69	RP-151441	0273	1		Sidelink terminology alignment in TS 36.304	12.6.0
2015-12	RP-70	RP-152048	0277	2		Enabling multiple NS and P-Max per cell	12.7.0
2015-12	RP-70	RP-152082	0285	1		Introduction of IDC Impact to Logged Measurements	13.0.0
	RP-70	RP-152075	0280	1		Extension of Frequency Priorities	13.0.0
	RP-70	RP-152066	0286	-		Introduction of ACDC in TS 36.304	13.0.0
	RP-70	RP-152080	0278	2		Introduction of SC-PTM	13.0.0
	RP-70	RP-152075	0281	3		Introduction of load redistribution in RRC_IDLE	13.0.0
	RP-70	RP-152072	0287	-		Introducing eSL	13.0.0
	RP-70	RP-152076	0288	-		Introducing extended DRX	13.0.0
2016-03	RP-71	RP-160456	0289	1		Correction on PO monitoring during paing window in eDRX	13.1.0
	RP-71	RP-160470	0290	1		Clarification of idle mode load distribution	13.1.0
	RP-71	RP-160454	0291	1		Miscellaneous corrections	13.1.0
	RP-71	RP-160456	0293	1		PTW terminology alignment	13.1.0
	RP-71	RP-160470	0295	1		Correction to E-UTRAN Inter-frequency Redistribution procedure_alt2	13.1.0
	RP-71	RP-160453	0299	3		The introduction of the Idle procedure for eMTC UE	13.1.0
	RP-71	RP-160457	0300	-		Introduction of WLAN RSSI measurements	13.1.0
2016-06	RP-72	RP-161080	0302	-		Correction for conditions of sidelink operation	13.2.0
	RP-72	RP-161080	0313	-		Corrections on nB extension	13.2.0
	RP-72	RP-161080	0315	-		Correction to eMTC message classes and logical channels	13.2.0
	RP-72	RP-161080	0312	-		Renaming UE_ID used for MCLD purposes	13.2.0
	RP-72	RP-161080	0304	1		Corrections on carrier frequency prioritization for PS sidelink discovery	13.2.0
	RP-72	RP-161080	0305	1		Correction to System Information change notifications in RRC_IDLE for MTCe	13.2.0
	RP-72	RP-161080	0314	1		Corrections on TS 36.304 for eMTC	13.2.0
	RP-72	RP-161080	0307	1		Clarification of UE behaviour immediately after T360 expiry	13.2.0
	RP-72	RP-161195	0311	2		Introduction of NB-IoT in 36.304	13.2.0
2016-09	RP-73	RP-161762	0321	-		The field name is not highlighted with italic	13.3.0
	RP-73	RP-161759	0322	2		Idle mode UE behaviour on user plane CIoT EPS optimisation	13.3.0
	RP-73	RP-161758	0325	1		Corrections to NB-IoT	13.3.0
	RP-73	RP-161762	0328	-		Clarification of UE redistribution target selection	13.3.0
	RP-73	RP-161762	0329	-		PH and PTW_Start calculation for eDRX paging	13.3.0
2016-09	RP-73	RP-161746	0324	1		Introduction of PC5 V2V for 36.304	14.0.0
2016-12	RP-74	RP-162314	0331	1		Editorial corrections to TS 36.304	14.1.0
	RP-74	RP-162328	0332	1		Corrections on V2V description in TS 36.304	14.1.0
	RP-74	RP-162313	0340	-		Clarification on TreselectionEUTRA_CE	14.1.0
	RP-74	RP-162327	0341	-		Support of eCall Only Mode for Network and Cell Selection	14.1.0
2017-03	RP-75	RP-170655	0344	-	A	Correction on channel bandwidth definition for NB-IoT	14.2.0
	RP-75	RP-170636	0347	1	B	Introduction of authorization of coverage enhancements	14.2.0
	RP-75	RP-170643	0349	1	F	Correction on V2X sidelink communication in limited service state in in TS 36.304	14.2.0
	RP-75	RP-170636	0350	1	B	Introduction of SC-PTM for FeMTC and NB-IoT	14.2.0
	RP-75	RP-170633	0351	1	B	Introduction of FeMBMS to 36.304	14.2.0
	RP-75	RP-170637	0352	1	B	Introduction of Rel-14 NB-IoT enhancements into idle mode	14.2.0
	RP-75	RP-170651	0357	-	A	Clarification for Hashed_ID	14.2.0
	RP-75	RP-170653	0358	-	A	Clarifications on reselection for eMTC	14.2.0
	RP-75	RP-170653	0360	-	A	New S-criteria for enhanced coverage in idle mode	14.2.0
	RP-75	RP-170635	0361	-	B	Introduction of PC5 V2X for 36.304	14.2.0
2017-06	RP-76	RP-171224	0363	2	F	Correction to paging carrier selection formula in Rel-14 NB-IoT	14.3.0
	RP-76	RP-171243	0370	2	A	Correction for eDRX Hashed ID	14.3.0
	RP-76	RP-171223	0376	2	F	Correction to usage of SC-PTM offset in NB-IoT and FeMTC	14.3.0
	RP-76	RP-171221	0380	1	F	Correction to Reselection priorities handling for FeMBMS	14.3.0
2017-09	RP-77	RP-171920	0386	1	A	Adding reference to SystemInformationBlockType1-BR to the clause on cell status and cell reservations	14.4.0
2017-12	RP-78	RP-172617	0392	2	C	Introduction of relaxed monitoring in NB-IoT	14.5.0
	RP-78	RP-172624	0397	2	A	Correction to cell barring for coverage enhancement	14.5.0
	RP-78	RP-172623	0399	1	A	Clarification on eDRX in NB-IoT	14.5.0
2018-03	RP-79	RP-180445	0402	4	F	Correction to relaxed monitoring reference RSRP reset (Alternative 1)	14.6.0
	RP-79	RP-180443	0405	1	C	Introduction of support of relaxed monitoring for BL and CE UE	14.6.0
	RP-79	RP-180443	0407	2	F	Support of CE mode B restriction for Rel-14 eMTC	14.6.0
2018-06	RP-80	RP-181228	0410	-	B	TS 36.304 running CR for HSDN	15.0.0
	RP-80	RP-181224	0411	r	B	EARFCN provisioning for UE in enhanced coverage	15.0.0
	RP-80	RP-181252	0416	2	B	Introduction of further NB-IoT enhancements in 36.304	15.0.0
	RP-80	RP-181224	0417	1	B	Introduction of further eMTC enhancements in 36.304	15.0.0
	RP-80	RP-181223	0419	1	B	Introduction of E-UTRA connected to 5GCN	15.0.0

	RP-80	RP-181228	0420	1	B	Support for Logging of 'Any cell selection' state	15.0.0
	RP-80	RP-181225	0729	1	B	Implementing network-based CRS interference mitigation	15.0.0
2018-09	RP-81	RP-181940	0412	4	B	Introduction of LTE to NR reselection in 36.304	15.1.0
	RP-81	RP-181950	0731	1	F	CR to 36.304 on CN selection for LTE connected to 5GC	15.1.0
	RP-81	RP-181963	0736	1	A	Correction to entering condition for relaxed monitoring	15.1.0
	RP-81	RP-181944	0737	3	F	Define relation between WUS occasion and PO	15.1.0
	RP-81	RP-181944	0740	2	F	Corrections for CRS muting in TS 36.304	15.1.0
	RP-81	RP-181950	0742	-	F	Correction on RRC_INACTIVE and camping on E-UTRA connected to 5GC in NB-IoT	15.1.0
	RP-81	RP-181940	0747	-	F	Paging Monitoring in Camped Normally state and Camped on Any Cell state	15.1.0
	RP-81	RP-181960	0748	-	F	Corrections to 36.304 speed dependent mobility and inter-RAT cells with cell reservations, access restrictions, or unsuitable for normal camping	15.1.0
2018-12	RP-82	RP-182671	0741	3	F	Small correction to paging with wake up signal	15.2.0
	RP-82	RP-182676	0744	5	F	Corrections to TS 36.304 for E-UTRA connected to 5GC	15.2.0
	RP-82	RP-182652	0750	1	F	Correction on paging for LTE connected to 5GC	15.2.0
	RP-82	RP-182676	0752	2	F	Clarification of Qoffsettemp for eLTE in 36.304	15.2.0
	RP-82	RP-182681	0757	1	F	Correction to gap determination for the wake-up signal	15.2.0
	RP-82	RP-182675	0758	-	F	TS36.304 CR on [103bis#43][LTEeLTE] Capture NR agreements	15.2.0
	RP-82	RP-182676	0762	-	F	TS36.304 CR on [104#23][LTE/5GC] Capture NR agreements	15.2.0
2019-03	RP-83	RP-190540	0763	1	F	Suitable cell criteria for reselection to NR cell	15.3.0
	RP-83	RP-190551	0764	-	F	CR on missing descprition of transmission pool sharing	15.3.0
2019-06	RP-84	RP-191380	0765	2	F	Correction to mobility state handling in case of LTE to NR reselection	15.4.0
2019-12	RP-86	RP-192941	0775	1	F	Correction on handling of stored AS context for UP optimization and RRC_INACTIVE state	15.5.0
2020-03	RP-87	RP-200360	0781	1	B	Introduction of Rel-16 eMTC enhancements	16.0.0
	RP-87	RP-200361	0783	1	B	Introduction of Rel-16 NB-IoT enhancements	16.0.0
	RP-87	RP-200349	0784	3	B	Correction of TS 36.304 to introduce IAB	16.0.0
	RP-87	RP-200346	0785	1	B	CR on cell selection/ reselection for NR V2X UE	16.0.0
2020-07	RP-88	RP-201191	0782	4	B	Introduce of alternative cell reselection priority for EN-DC	16.1.0
	RP-88	RP-201179	0786	4	F	Miscellaneous correction to 36.304 for IAB	16.1.0
	RP-88	RP-201193	0788	4	F	Corrections to Rel-16 NB-IoT enhancements	16.1.0
	RP-88	RP-201192	0789	4	F	Corrections to WUS group for eMTC	16.1.0
	RP-88	RP-201172	0790	-	B	White listed cells for reselection to NR-U	16.1.0
	RP-88	RP-201168	0794	1	A	Clarification for CP EDT	16.1.0
	RP-88	RP-201176	0803	2	F	CR on cell (re)selection for sidelink in TS 36.304	16.1.0
2020-09	RP-89	RP-201936	0796	3	F	System support for Wake Up Signal	16.2.0
	RP-89	RP-201928	0805	1	F	Corrections to 36.304	16.2.0
	RP-89	RP-201938	0807	1	A	Correction on Srxlev Calculation for IRAT Cell Reselection	16.2.0
	RP-89	RP-201928	0808	2	F	Miscellaneous corrections to NB-IoT Rel-16 enhancements	16.2.0
	RP-89	RP-201928	0810	1	F	(G)WUS corrections	16.2.0
	RP-89	RP-201923	0812	-	F	Miscellaneous corrections for TS 36.304 for IAB	16.2.0

History

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