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Contents

Foreword

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1 Scope

The present document specifies the Access Stratum (AS) part of the UE procedures in RRC_IDLE state (also called Idle mode) and RRC_INACTIVE state. The non-access stratum (NAS) part of Idle mode procedures and processes is specified in TS 23.122 [9].

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 NR Radio Access, including multi-RAT UEs as described in 3GPP specifications, in the following cases:

- When the UE is camped on a NR 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 RATs.

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 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 38.300: "NR Overall Description; Stage 2".

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

[4] 3GPP TS 38.213: "NR; Physical layer procedures for control ".

[5] Void

[6] 3GPP TS 36.331: "E-UTRA; Radio Resource Control (RRC) - Protocol Specification".

[7] 3GPP TS 36.304: "E-UTRA; User Equipment (UE) procedures in RRC_IDLE state ".

[8] 3GPP TS 38.133: "NR; Requirements for Support of Radio Resource Management".

[9] 3GPP TS 23.122: "NAS functions related to Mobile Station (MS) in RRC_IDLE state".

[10] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[11] 3GPP TS 38.215: "NR; Physical layer measurements".

[12] 3GPP TS 22.261: "Service requirements for the 5G system".

[13] 3GPP TS 24.890: "5G System – Phase 1; CT WG1 Aspects".

[14] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[15] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[16] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services".

[17] 3GPP TS 23.285: "Technical Specification Group Services and System Aspects; Architecture enhancements for V2X services".

[18] 3GPP TS 22.011: "Service accessibility".

3 Definitions, symbols 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 4.5.

Allowed CAG list: A per-PLMN list of CAG Identifiers the UE is allowed to access (see TS 23.501 [10])**.**

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.

CAG cell: A cell broadcasting at least one Closed Access Group Identifier.

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 Access Group Identifier: Identifier of a CAG within a PLMN.

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

eCall Only Mode: A UE configuration option that allows the UE to register at 5GC 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 [9].

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.

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.

Network Identifier: Identifier of an SNPN in combination with a PLMN ID (TS 23.501 [10]).

Non-Public Network: A network deployed for non-public use, as defined in TS 22.261 [12].

NR sidelink communication: AS functionality enabling at least V2X Communication as defined in TS 23.287 [16], between two or more nearby UEs, using NR technology but not traversing any network node.

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

Radio Access Technology: Type of technology used for radio access, for instance NR or E-UTRA.

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.

Registered PLMN: This is the PLMN on which certain Location Registration outcomes have occurred, as specified in TS 23.122 [9].

Registered SNPN: This is the SNPN on which certain Location Registration outcomes have occurred, as specified in TS 23.122 [9].

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

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

Selected SNPN: This is the SNPN 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 V2X sidelink communication defined in TS 23.287[16].

SNPN Access Mode: Mode of operation wherein UE only selects SNPNs (as defined in TS 23.501 [10]).

SNPN identity: An identifier of an SNPN comprising of a PLMN ID and an NID combination.

Strongest cell: The cell on a particular frequency that is considered strongest according to the layer 1 cell search procedure (TS 38.213 [4], TS 38.215 [11]).

Suitable Cell: This is a cell on which a UE may camp. For NR cell, the criteria are defined in clause 4.5, for E-UTRA cell in TS 36.304 [7].

V2X sidelink communication: AS functionality enabling V2X Communication as defined in TS 23.285 [17], between nearby UEs, using E-UTRA technology but not traversing any network node.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

AS	Access Stratum
CAG	Closed Access Group
CAG-ID	Closed Access Group Identifier
CMAS	Commercial Mobile Alert System
CN	Core Network
DCI	Downlink Control Information
ETWS	Earthquake and Tsunami Warning System
E-UTRA	Evolved UMTS Terrestrial Radio Access
E-UTRAN	Evolved UMTS Terrestrial Radio Access Network
HRNN	Human-Readable Network Name
IAB	Integrated Access and Backhaul
IMSI	International Mobile Subscriber Identity
MCC	Mobile Country Code
MICO	Mobile Initiated Connection Only
NAS	Non-Access Stratum
NID	Network Identifier
NPN	Non-Public Network
NR	NR Radio Access
PLMN	Public Land Mobile Network
RAT	Radio Access Technology
RNA	RAN-based Notification Area
RNAU	RAN-based Notification Area Update
RRC	Radio Resource Control
SNPN	Stand-alone Non-Public Network
UAC	Unified Access Control
UE	User Equipment
UMTS	Universal Mobile Telecommunications System

V2X Vehicle to Everything

4 General description of RRC_IDLE state and RRC_INACTIVE state

4.1 Overview

The RRC_IDLE state and RRC_INACTIVE state tasks can be subdivided into three processes:

- PLMN selection (for UE not operating in SNPN access mode) or SNPN selection (for UE operating in SNPN access mode);
- Cell selection and reselection;
- Location registration and RNA update.

PLMN selection, SNPN selection, cell reselection procedures, and location registration are common for both RRC_IDLE state and RRC_INACTIVE state. RNA update is only applicable for RRC_INACTIVE state. When UE selects a new PLMN or SNPN, UE transitions from RRC_INACTIVE to RRC_IDLE, as specified in TS 24.501 [14].

When a UE is switched on, a public land mobile network (PLMN) or a SNPN is selected by NAS. For the selected PLMN/SNPN, associated RAT(s) may be set, as specified in TS 23.122 [9]. The NAS shall provide a list of equivalent PLMNs, if available, that the AS shall use for cell selection and cell reselection.

With cell selection, the UE searches for a suitable cell of the selected PLMN or selected SNPN, chooses that cell to provide available services, and monitors its control channel. This procedure is defined as "camping on the cell".

The UE shall, if necessary, then register its presence, by means of a NAS registration procedure, in the tracking area of the chosen cell. As an outcome of a successful Location Registration, the selected PLMN/SNPN then becomes the registered PLMN/SNPN, as specified in TS 23.122 [9].

If the UE finds a more suitable cell, according to the cell reselection criteria, it reselects onto that cell and camps on it. 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, an RNA update procedure is performed.

If necessary, the UE shall search for higher priority PLMNs at regular time intervals as described in TS 23.122 [9] and search for a suitable cell if another PLMN has been selected by NAS.

For UE not operating in SNPN access mode, search of available CAGs may be triggered by NAS to support manual CAG selection. The AS shall report available CAG-ID(s) together with their HRNN (if broadcast) and PLMN(s) to the NAS.

If the UE loses coverage of the registered PLMN/SNPN, either a new PLMN/SNPN is selected automatically (automatic mode), or an indication of available PLMNs/SNPNs is given to the user so that a manual selection can be performed (manual mode). As part of manual SNPN selection, the AS shall report available SNPN identifiers together with their HRNN (if broadcast) to the NAS.

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

The UE may perform NR sidelink communication and/or V2X sidelink communication while in-coverage or out-of-coverage for sidelink, as specified in clause 8.

The purpose of camping on a cell in RRC_IDLE state and RRC_INACTIVE state is fourfold:

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

b) When registered and if the UE wishes to establish an RRC connection or resume a suspended 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 network needs to send a message or deliver data to the registered UE, it knows (in most cases) the set of tracking areas (in RRC_IDLE state) or RNA (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 the corresponding set of areas. The UE will then receive the paging message and can respond.

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

When the UE is in RRC_IDLE state, upper layers may deactivate AS layer when MICO mode is activated as specified in TS 24.501 [14]. When MICO mode is activated, the AS configuration (e.g. priorities provided by dedicated signalling) is kept and all running timers continue to run but the UE need not perform any idle mode tasks. If a timer expires while MICO mode is activated it is up to the UE implementation whether it performs the corresponding action immediately or the latest when MICO mode is deactivated. When MICO mode is deactivated, the UE shall perform all idle mode tasks.

4.2 Functional division between AS and NAS in RRC_IDLE state and RRC_INACTIVE state

Table 4.2-1 presents the functional division between UE non-access stratum (NAS) and UE access stratum (AS) in RRC_IDLE state and RRC_INACTIVE states. The NAS part is specified in TS 23.122 [9] and the AS part in the present document.

Table 4.2-1: Functional division between AS and NAS in RRC_IDLE state and RRC_INACTIVE state

RRC_IDLE and RRC_INACTIVE state Process	UE Non-Access Stratum	UE Access Stratum
PLMN Selection	**For a UE not operating in SNPN access mode, perform the following:** Maintain a list of PLMNs in priority order according to TS 23.122 [9]. Select a PLMN using automatic or manual mode as specified in TS 23.122 [9] 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 any associated CAG-IDs from AS for PLMN selection. Maintain a list of equivalent PLMN identities. To support manual CAG selection, provide request to search for available CAGs and evaluate reports of available CAGs from AS for CAG selection. **For a UE operating in SNPN access mode, perform the following:** Maintain a list of SNPNs according to TS 23.122 [9]. Select a SNPN using automatic or manual mode as specified in TS 23.122 [9] and request AS to select a cell belonging to this SNPN. Evaluate reports of available SNPNs from AS for SNPN selection.	For a UE not operating in SNPN access mode, 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 [9]. For a UE operating in SNPN access mode, search for available SNPNs only consider NR cells. Perform measurements to support PLMN/SNPN selection. Synchronise to a broadcast channel to identify found PLMNs/SNPNs. Report available PLMNs and any associated CAG-IDs with associated RAT(s) to NAS on request from NAS or autonomously. For a UE operating in SNPN access mode, report available SNPNs to NAS autonomously. **To support manual CAG selection, perform the following:** Search for cells broadcasting a CAG-ID. Read the HRNN (if broadcast) for each CAG-ID if a cell broadcasting a CAG-ID is found. Report CAG-ID(s) of found cell(s) broadcasting a CAG-ID together with the associated manual CAG selection allowed indicator, HRNN and PLMNto NAS. On selection of a CAG by NAS, select any acceptable or suitable cell belonging to the selected CAG and give an indication to NAS that access is possible (for the registration procedure) To support manual SNPN selection, report available SNPNs together with associated HRNNs (if available) to NAS on request from NAS.

RRC_IDLE and RRC_INACTIVE state Process	UE Non-Access Stratum	UE Access Stratum
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. Maintain a list of "Forbidden Tracking Areas" and provide the list to AS. For a UE not operating in SNPN access mode: Maintain Allowed CAG list and optional CAG-only indication along with associated PLMN ID(s) on which the UE is allowed access and provide these lists to AS. To support manual CAG selection, select a CAG and request AS to select a cell belonging to this CAG.	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' or 'SNPN identity' (for a UE operating in SNPN access mode) 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 [9]. If a cell is found which satisfies cell selection criteria, camp on that cell.
Cell Reselection	For a UE not operating in SNPN access mode, maintain a list of equivalent PLMN identities and provide the list to AS. Maintain a list of "Forbidden Tracking Areas" and provide the list to AS. For a UE not operating in SNPN access mode, maintain Allowed CAG list and optional CAG-only indication along with associated PLMN ID(s) on which the UE is allowed access and provide these lists to AS.	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.
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. Deregister UE when shutting down. Maintain a list of "Forbidden Tracking Areas". Control and restrict location registration for a UE in eCall Only Mode.	Report registration area information to NAS.
RAN Notification Area Update	Not applicable.	Register the UE's presence in a RAN-based notification area (RNA), periodically or when entering a new RNA.

4.3 Service types in RRC_IDLE state

This clause defines the level of service that may be provided by the network to a UE in RRC_IDLE state. The following three levels of services are provided while a UE is in RRC_IDLE state:

- Limited service (emergency calls, ETWS and CMAS on an acceptable cell);

- Normal service (for public use or non-public use on a suitable cell);
- Operator service (for operators only on a reserved cell).

4.4 Service types in RRC_INACTIVE state

This clause defines the level of service that may be provided by the network to a UE in RRC_INACTIVE state. The following two levels of services are provided while a UE is in RRC_INACTIVE state:

- Normal service (for public use or non-public use on a suitable cell);
- Operator service (for operators only on a reserved cell).

4.5 Cell Categories

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). 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 an NR 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:

For UE not operating in SNPN Access Mode, a cell is considered as suitable if the following conditions are fulfilled:

- The cell is part of either the selected PLMN or the registered PLMN or PLMN of the Equivalent PLMN list, and for that PLMN either:
  - The PLMN-ID of that PLMN is broadcast by the cell with no associated CAG-IDs and CAG-only indication in the UE for that PLMN (TS 23.501 [10]) is absent or false;
  - Allowed CAG list in the UE for that PLMN (TS 23.501 [10]) includes a CAG-ID broadcast by the cell for that PLMN;
- The cell selection criteria are fulfilled, see clause 5.2.3.2.

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 [18]), which belongs to a PLMN that fulfils the first bullet above.

For UE operating in SNPN Access Mode, a cell is considered as suitable if the following conditions are fulfilled:

- The cell is part of either the selected SNPN or the registered SNPN of the UE;
- The cell selection criteria are fulfilled, see clause 5.2.3.2;

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" which belongs to either the selected SNPN or the registered SNPN of the UE.

barred cell:

A cell is barred if it is so indicated in the system information, as specified in TS 38.331 [3].

reserved cell:

A cell is reserved if it is so indicated in system information, as specified in TS 38.331 [3].

Following exception to these definitions are applicable for UEs:

- 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.
- 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 [9], TS 24.501 [14]) is suitable but provides only limited service.
- if the UE in RRC_IDLE fulfils the conditions to support NR sidelink communication or V2X sidelink communication in limited service state as specified in TS23.287 [16] clause 5.7, the UE may perform NR sidelink communication or V2X sidelink communication.

NOTE: UE is not required to support manual search and selection of PLMN or CAG or SNPN 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.

5 Process and procedure descriptions

5.1 PLMN selection and SNPN selection

In the UE not operating in SNPN access mode, the AS shall report available PLMNs and any associated CAG-IDs to the NAS on request from the NAS or autonomously. In the UE operating in SNPN access mode, the AS shall report available SNPNs to the NAS on request from the NAS or autonomously.

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' in a given cell. The result of the PLMN selection performed by NAS (see TS 23.122 [9]) is an identifier of the selected PLMN.

During SNPN selection, based on the list of SNPN identities, the particular SNPN may be selected either automatically or manually. Each SNPN in the list of SNPN identities is identified by a 'SNPN identity'. In the system information on the broadcast channel, the UE can receive one or multiple 'SNPN identity' in a given cell and optionally may receive associated HRNNs. The result of the SNPN selection performed by NAS (see TS 23.122 [9]) is an identifier of the selected SNPN.

5.1.1 Support for PLMN selection

5.1.1.1 General

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

5.1.1.2 NR case

The UE shall scan all RF channels in the NR bands according to its capabilities to find available PLMNs and available CAGs. 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 and any associated CAG(s). For operation with shared spectrum channel access, the UE may also read the system information of multiple strongest cell(s). If the UE can read one or several PLMN identities in the strongest cell or the multiple strongest cell(s) in case of operation with shared spectrum channel access, each found PLMN (see the PLMN reading in TS 38.331 [3]) shall be reported to the NAS as a high quality PLMN (but without the RSRP value) and any associated CAG-ID, provided that the following high-quality criterion is fulfilled:

1. For an NR 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 their corresponding RSRP values and any associated CAG-ID. The quality measure reported by the UE to NAS shall be the same for each PLMN found in one cell.

The search for PLMNs may be stopped on request from the NAS. The UE may optimise PLMN search by using stored information e.g. 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.

To support manual CAG selection, the UE shall upon request by NAS report available CAG-ID(s) together with their manual CAG selection allowed indicator (if broadcast), HRNN (if broadcast) and PLMN(s) to the NAS. If NAS has selected a CAG and provided this selection to AS, the UE shall search for an acceptable or suitable cell belonging to the selected CAG to camp on.

5.1.1.3 E-UTRA case

Support for PLMN selection in E-UTRA is described in TS 36.304 [7].

5.1.2 Support for SNPN selection

5.1.2.1 General

On request of the NAS, the AS shall perform a search for available SNPNs on only NR cells and report them to NAS.

5.1.2.2 NR case

The UE shall scan all RF channels in the NR bands according to its capabilities to find available SNPNs. On each carrier, the UE shall search for the strongest cell and read its system information, in order to find out which SNPN(s) the cell belongs to. For operation with shared spectrum channel access, the UE may also read the system information of multiple strongest cell(s). If the UE can read one or several SNPN identities in the strongest cell, each found SNPN (see the SNPN reading in TS 38.331 [3]) shall be reported to the NAS. For manual selection, UE shall upon request by NAS report available SNPN identifiers together with their HRNN (if broadcast) to the NAS and the search for available SNPNs may be stopped on request of the NAS.

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

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

5.2 Cell selection and reselection

5.2.1 Introduction

UE shall perform measurements for cell selection and reselection purposes as specified in TS 38.133 [8].

When evaluating Srxlev and Squal of non-serving cells for reselection evaluation purposes, the UE shall use parameters provided by the serving cell and for the final check on cell selection criterion, the UE shall use parameters provided by the target cell for cell reselection.

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 RRC_IDLE or RRC_INACTIVE state measurements and cell selection criteria.

In order to expedite the cell selection process, stored information for several RATs, if available, may be used by 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. Details on performance requirements for cell reselection can be found in TS 38.133 [8].

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

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

- receive system information from the PLMN or SNPN; and
  - receive registration area information from the PLMN or SNPN, e.g., tracking area information; and
  - receive other AS and NAS Information; and
- if registered:
  - receive paging and notification messages from the PLMN or SNPN; and
  - initiate transfer to Connected mode.

For cell selection in multi-beam operations, measurement quantity of a cell is up to UE implementation.

For cell reselection in multi-beam operations, including inter-RAT reselection from E-UTRA to NR, the measurement quantity of this cell is derived amongst the beams corresponding to the same cell based on SS/PBCH block as follows:

- if *nrofSS-BlocksToAverage* (*maxRS-IndexCellQual* in E-UTRA) is not configured in *SIB2/SIB4* (*SIB24* in E-UTRA); or
- if *absThreshSS-BlocksConsolidation* (*threshRS-Index* in E-UTRA) is not configured in *SIB2/SIB4* (*SIB24* in E-UTRA); or
- if the highest beam measurement quantity value is below or equal to *absThreshSS-BlocksConsolidation* (*threshRS-Index* in E-UTRA):
  - derive a cell measurement quantity as the highest beam measurement quantity value, where each beam measurement quantity is described in TS 38.215 [11].
- else:
  - derive a cell measurement quantity as the linear average of the power values of up to *nrofSS-BlocksToAverage* (*maxRS-IndexCellQual* in E-UTRA) of highest beam measurement quantity values above *absThreshSS-BlocksConsolidation* (*threshRS-Index* in E-UTRA).

5.2.2 States and state transitions in RRC_IDLE state and RRC_INACTIVE state

Figure 5.2.2-1 shows the states and state transitions and procedures in RRC_IDLE and RRC_INACTIVE. Whenever a new PLMN selection or new SNPN selection is performed, it causes an exit to number 1.

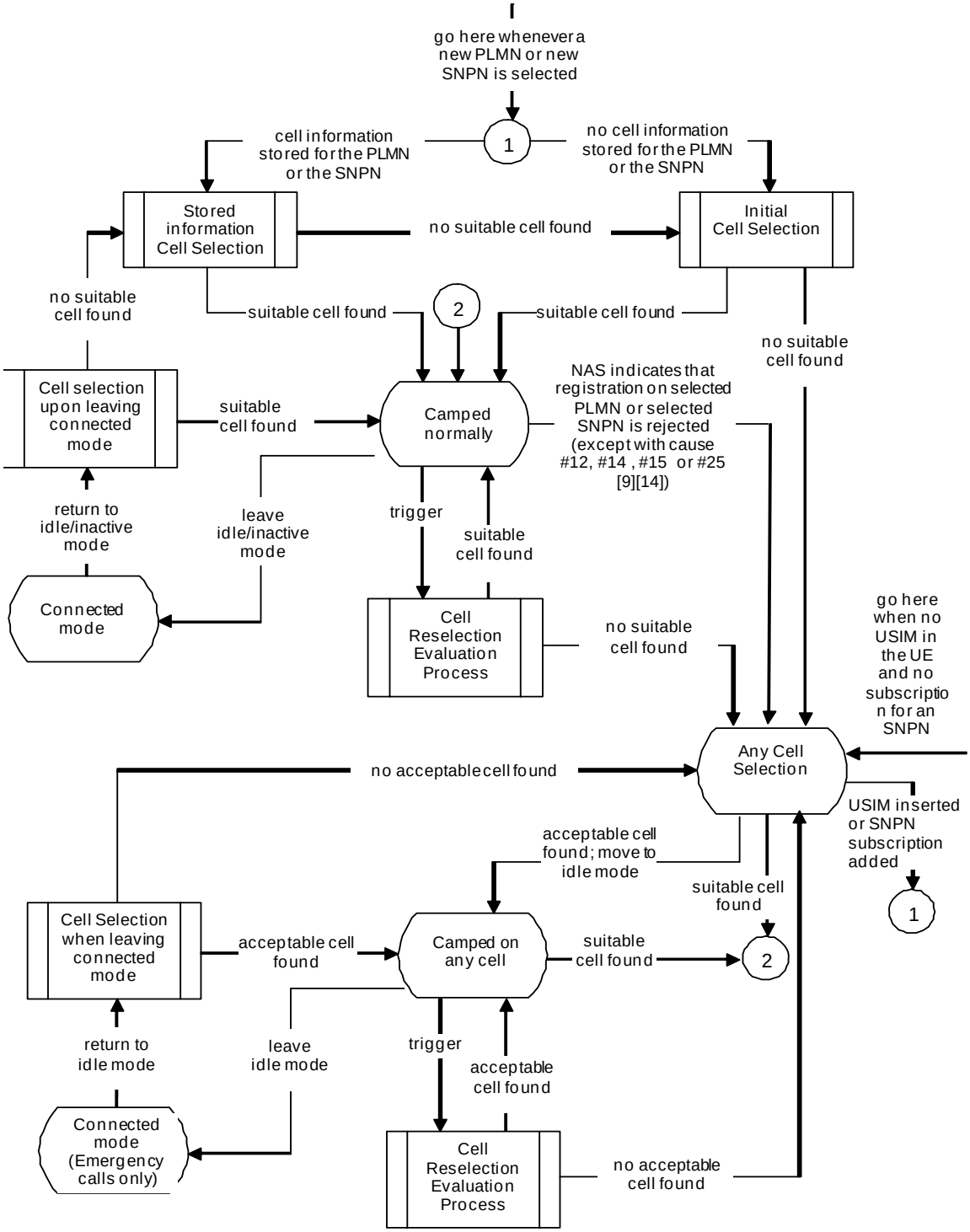

Figure 5.2.2-1: RRC_IDLE and RRC_INACTIVE Cell Selection and Reselection

5.2.3 Cell Selection process

5.2.3.1 Description

Cell selection is performed by one of the following two procedures:

a) Initial cell selection (no prior knowledge of which RF channels are NR frequencies):

1. The UE shall scan all RF channels in the NR bands according to its capabilities to find a suitable cell.
2. On each frequency, the UE need only search for the strongest cell, except for operation with shared spectrum channel access where the UE may search for the next strongest cell(s).
3. Once a suitable cell is found, this cell shall be selected.

b) Cell selection by leveraging stored information:

1. This procedure requires stored information of frequencies and optionally also information on cell parameters from previously received measurement control information elements or from previously detected cells.
2. Once the UE has found a suitable cell, the UE shall select it.
3. If no suitable cell is found, the initial cell selection procedure in a) shall be started.

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

5.2.3.2 Cell Selection Criterion

The cell selection criterion S is fulfilled when:

$Srxlev > 0$ AND $Squal > 0$

where:

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

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

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 38.331 [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). If the UE supports SUL frequency for this cell, $Q_{rxlevmin}$ is obtained from *q-RxLevMinSUL*, if present, in *SIB1*, *SIB2* and *SIB4*, additionally, if $Q_{rxlevminoffsetcellSUL}$ is present in *SIB3* and *SIB4* for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell; else $Q_{rxlevmin}$ is obtained from *q-RxLevMin* in *SIB1, SIB2* and *SIB4*, additionally, if $Q_{rxlevminoffsetcell}$ is present in *SIB3* and *SIB4* for the concerned cell, this cell specific offset is added to the corresponding Qrxlevmin to achieve the required minimum RX level in the concerned cell.
$Q_{qualmin}$	Minimum required quality level in the cell (dB). Additionally, if $Q_{qualminoffsetcell}$ is signalled for the concerned cell, this cell specific offset is added to achieve the required minimum quality level in the concerned 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, as specified in TS 23.122 [9].
$Q_{qualminoffset}$	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, as specified in TS 23.122 [9].
$P_{compensation}$	For FR1, if the UE supports the *additionalPmax* in the *NR-NS-PmaxList*, if present, in *SIB1, SIB2* and *SIB4:* *max(P_{EMAX1} –$P_{PowerClass}$, 0) – (min(P_{EMAX2}, $P_{PowerClass}$) – min(P_{EMAX1}, $P_{PowerClass}$)) (dB);* *else:* *max(P_{EMAX1} –$P_{PowerClass}$, 0) (dB)* For FR2, $P_{compensation}$ is set to 0.
P_{EMAX1}, P_{EMAX2}	Maximum TX power level of a UE may use when transmitting on the uplink in the cell (dBm) defined as P_{EMAX} in TS 38.101 [15]. If UE supports SUL frequency for this cell, P_{EMAX1} and P_{EMAX2} are obtained from the *p-Max* for SUL in *SIB1* and *NR-NS-PmaxList* for SUL respectively in *SIB1, SIB2* and *SIB4* as specified in TS 38.331 [3], else P_{EMAX1} and P_{EMAX2} are obtained from the *p-Max* and *NR-NS-PmaxList* respectively in *SIB1*, *SIB2* and *SIB4* for normal UL as specified in TS 38.331 [3].
$P_{PowerClass}$	Maximum RF output power of the UE (dBm) according to the UE power class as defined in TS 38.101-1 [15].

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 [9]). 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.

5.2.3.3 E-UTRAN case in Cell Selection

The cell selection criteria and procedures in E-UTRAN are specified in TS 36.304 [7].

5.2.4 Cell Reselection evaluation process

5.2.4.1 Reselection priorities handling

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an NR 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 provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease* 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). If the UE is configured to perform both NR sidelink communication and V2X sidelink communication, the UE may consider the frequency providing both NR sidelink communication configuration and V2X sidelink communication configuration to be the highest priority. If the UE is configured to perform NR sidelink communication and not perform V2X communication, the UE may consider the frequency providing 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.

NOTE 1: The frequency only providing the anchor frequency configuration should not be prioritized for V2X service during cell reselection, as specified in TS 38.331[3].

NOTE 2: 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 3: The prioritization among the frequencies which UE considers to be the highest priority frequency is left to UE implementation.

NOTE 4: 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 5: 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.

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

In case UE receives *RRCRelease* with *deprioritisationReq*, UE shall consider current frequency and stored frequencies due to the previously received *RRCRelease* with *deprioritisationReq* or all the frequencies of NR 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 or SNPN selection is performed on request by NAS (TS 23.122 [9]).

NOTE: 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 38.133 [8] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or
- the optional validity time of dedicated priorities (T320) expires; or
- the UE receives an *RRCRelease* message with the field *cellReselectionPriorities* absent; or
- a PLMN selection or SNPN selection is performed on request by NAS (TS 23.122 [9]).

NOTE 2: Equal priorities between RATs are not supported.

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

The UE shall consider only the white listed cells, if configured, as candidates for cell reselection.

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

NOTE 3: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

5.2.4.2 Measurement rules for cell re-selection

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 NR 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 a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].
  - For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:
    - If the serving cell fulfils Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, the UE may choose not to perform measurements of NR inter-frequency cells of equal or lower priority, or inter-RAT frequency cells of lower priority;
    - Otherwise, the UE shall perform measurements of NR inter-frequency cells of equal or lower priority, or inter-RAT frequency cells of lower priority according to TS 38.133 [8].
- If the UE supports relaxed measurement and *relaxedMeasurement* is present in *SIB2*, the UE may further relax the needed measurements, as specified in clause 5.2.4.9.

5.2.4.3 Mobility states of a UE

5.2.4.3.0 Introduction

The UE mobility state is determined if the parameters (T_{CRmax}, N_{CR_H}, N_{CR_M} and $T_{CRmaxHyst}$) are broadcasted in system information for the serving cell.

State detection criteria:

Normal-mobility state criteria:

- If number of cell reselections during time period T_{CRmax} is less than N_{CR_M}.

Medium-mobility state criteria:

- If number of cell reselections during time period T_{CRmax} is greater than or equal to N_{CR_M} but less than or equal to N_{CR_H}.

High-mobility state criteria:

- If number of cell reselections during time period T_{CRmax} is greater than N_{CR_H}.

The UE shall not consider consecutive reselections where a cell is reselected again right after one reselection for mobility state detection criteria.

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 High-mobility 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 broadcasted in system information;
  - For NR cells, multiply $Treselection_{NR}$ by the *sf-High* of "Speed dependent ScalingFactor for $Treselection_{NR}$" if broadcasted in system information;
  - For EUTRA cells, multiply $Treselection_{EUTRA}$ by the *sf-High* of "Speed dependent ScalingFactor for $Treselection_{EUTRA}$" if broadcasted in system information.
- If Medium-mobility state is detected:
  - Add the *sf-Medium* of "Speed dependent ScalingFactor for Q_{hyst}" to Q_{hyst} if broadcasted in system information;
  - For NR cells, multiply $Treselection_{NR}$ by the *sf-Medium* of "Speed dependent ScalingFactor for $Treselection_{NR}$" if broadcasted in system information;
  - For EUTRA cells, multiply $Treselection_{EUTRA}$ by the *sf-Medium* of "Speed dependent ScalingFactor for $Treselection_{EUTRA}$" if broadcasted in 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 due to one or more of the following reasons:

- this cell belongs to a PLMN which is not indicated as being equivalent to the registered PLMN, or
- this cell is a CAG cell that belongs to a PLMN which is equivalent to the registered PLMN but with no CAG-ID that is present in the UE's allowed CAG list being broadcasted, or
- this cell is not a CAG cell and the CAG-only indication in the UE is set, or
- this cell does not belong to a SNPN that is equal to the registered or selected SNPN of the UE in SNPN access mode,

the UE shall not consider this cell and, for operation in licensed spectrum, other cells on the same frequency as candidates for reselection for a maximum of 300 seconds.

For operation with shared spectrum channel access, when the highest ranked cell or best cell is not a candidate for reselection per the previous paragraph, the UE should continue to consider other cells on the same frequency for cell reselection, however if the second highest ranked cell on this frequency is also not suitable due to one or more of the above reasons, the UE may consider this frequency to be the lowest priority for a maximum of 300 seconds.

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 due to being part of the "list of 5GS forbidden TAs for roaming", the UE shall not consider this cell and other cells on the same frequency as candidates for reselection for a maximum of 300 seconds.

If the UE enters into state *any cell selection*, any limitation 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 300 seconds. If the UE enters into state *any cell selection*, any limitation shall be removed. If the UE is redirected under NR control to a frequency for which the timer is running, any limitation on that frequency shall be removed.

5.2.4.5 NR Inter-frequency and inter-RAT Cell Reselection criteria

If *threshServingLowQ* is broadcast in system information 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 NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > $Thresh_{X, HighQ}$ during a time interval $Treselection_{RAT}$

Otherwise, cell reselection to a cell on a higher priority NR 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 NR frequency shall be based on ranking for intra-frequency cell reselection as defined in clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information 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 NR 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 NR or E-UTRAN RAT/ frequency fulfils Squal > $Thresh_{X, LowQ}$ during a time interval $Treselection_{RAT}$.

Otherwise, cell reselection to a cell on a lower priority NR 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.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, the highest ranked 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, the strongest cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

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:

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

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

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: Equals to $Qoffset_{s,n}$ plus $Qoffset_{frequency}$, if $Qoffset_{s,n}$ is valid, otherwise this equals to $Qoffset_{frequency}$.
$Qoffset_{temp}$	Offset temporarily applied to a cell as specified in TS 38.331 [3].

The UE shall perform ranking of all cells that fulfil the cell selection criterion S, which is defined in 5.2.3.2.

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

If *rangeToBestCell* is not configured, the UE shall perform cell reselection to the highest ranked cell. If this cell is found to be not-suitable, the UE shall behave according to clause 5.2.4.4.

If *rangeToBestCell* is configured, then the UE shall perform cell reselection to the cell with the highest number of beams above the threshold (i.e. *absThreshSS-BlocksConsolidation*) among the cells whose R value is within *rangeToBestCell* of the R value of the highest ranked cell. If there are multiple such cells, the UE shall perform cell reselection to the highest ranked cell among them. 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 than the serving cell according to the cell reselection criteria specified above during a time interval $Treselection_{RAT}$;
- more than 1 second has elapsed since the UE camped on the current serving cell.

NOTE: If *rangeToBestCell* is configured but *absThreshSS-BlocksConsolidation* is not configured on an NR frequency, the UE considers that there is one beam above the threshold for each cell on that frequency.

5.2.4.7 Cell reselection parameters in system information broadcasts

5.2.4.7.0 General reselection parameters

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

absThreshSS-BlocksConsolidation

This specifies the minimum threshold for beams which can be used for selection of the highest ranked cells, if *rangeToBestCell* is configured, and for beams used for derivation of cell measurement quantity. The parameter in *SIB2* applies to the current serving frequency and the parameter in *SIB4* applies to the corresponding inter-frequency.

cellReselectionPriority

This specifies the absolute priority for NR frequency or E-UTRAN frequency.

cellReselectionSubPriority

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

combineRelaxedMeasCondition

This indicates when the UE needs to fulfil both low mobility criterion and not-at-cell-edge criterion to determine whether to relax measurement requirements.

highPriorityMeasRelax

This indicates whether measurement on higher priority frequency is allowed to be relaxed as specified in clause 5.2.4.9.0.

nrofSS-BlocksToAverage

This specifies the number of beams which can be used for selection of the highest ranked cell, if *rangeToBestCell* is configured, and the number of beams used for derivation of cell measurement quantity. The parameter in *SIB2* applies to the current serving frequency and the parameter in *SIB4* applies to the corresponding inter-frequency.

$Qoffset_{s,n}$

This specifies the offset between the two cells.

$Qoffset_{frequency}$

Frequency specific offset for equal priority NR frequencies.

Q_{hyst}

This specifies the hysteresis value for ranking criteria.

$Qoffset_{temp}$

This specifies the additional offset to be used for cell selection and re-selection. It is temporarily used in case the RRC Connection Establishment fails on the cell as specified in TS 38.331 [3].

$Q_{qualmin}$

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

$Q_{rxlevmin}$

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

$Q_{rxlevminoffsetcell}$

This specifies the cell specific Rx level offset in dB to Qrxlevmin.

$Q_{qualminoffsetcell}$

This specifies the cell specific quality level offset in dB to Qqualmin.

rangeToBestCell

This specifies the R value range which the cells whose R value is within the range can be a candidate for the highest ranked cell. It is configured in SIB2 and used for intra-frequency and equal priority inter-frequency cell reselection and among the cells on the highest priority frequency(ies) for inter-frequency cell reselection within NR.

$S_{IntraSearchP}$

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 NR inter-frequency and inter-RAT measurements.

$S_{nonIntraSearchQ}$

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

$S_{SearchDeltaP}$

This specifies the threshold (in dB) on Srxlev variation for relaxed measurement.

$S_{SearchThresholdP}$

This specifies the Srxlev threshold (in dB) for relaxed measurement.

$S_{SearchThresholdQ}$

This specifies the Squal threshold (in dB) for relaxed measurement.

$Treselection_{RAT}$

This specifies the cell reselection timer value. For each target NR frequency and for each RAT other than NR, a specific value for the cell reselection timer is defined, which is applicable when evaluating reselection within NR or towards other RAT (i.e. $Treselection_{RAT}$ for NR is $Treselection_{NR}$, for E-UTRAN $Treselection_{EUTRA}$).

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

$Treselection_{NR}$

This specifies the cell reselection timer value $Treselection_{RAT}$ for NR. The parameter can be set per NR frequency as specified in TS 38.331 [3].

$Treselection_{EUTRA}$

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

$Thresh_{X, HighP}$

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 NR and E-UTRAN 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 NR and E-UTRAN 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 NR and E-UTRAN 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 NR and E-UTRAN 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.

$T_{SearchDeltaP}$

This specifies the time period over which the Srxlev variation is evaluated for relaxed measurement.

5.2.4.7.1 Speed dependent reselection parameters

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

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.

5.2.4.8 Inter-RAT Cell reselection in RRC_INACTIVE state

For UE in the RRC_INACTIVE state, upon cell reselection to another RAT, UE transitions from RRC_INACTIVE to RRC_IDLE and performs actions as specified in TS 38.331 [3].

5.2.4.9 Relaxed measurement

5.2.4.9.0 Relaxed measurement rules

When the UE is required to perform measurements of intra-frequency cells or NR inter-frequency cells or inter-RAT frequency cells according to the measurement rules in clause 5.2.4.2:

- if *lowMobilityEvaluation* is configured and *cellEdgeEvaluation* is not configured; and
- if the UE has performed normal intra-frequency, NR inter-frequency, or inter-RAT frequency measurements for at least $T_{SearchDeltaP}$ after (re-)selecting a new cell; and
- if the relaxed measurement criterion in clause 5.2.4.9.1 is fulfilled for a period of $T_{SearchDeltaP}$:
  - the UE may choose to perform relaxed measurements for intra-frequency cells according to relaxation methods in clauses 4.2.2.9 in TS 38.133 [8];
  - if the serving cell fulfils $Srxlev > S_{nonIntraSearchP}$ and $Squal > S_{nonIntraSearchQ}$:
    - for any NR inter-frequency or inter-RAT frequency of higher priority, if less than 1 hour has passed since measurements of corresponding frequency cell(s) for cell reselection were last performed; and,
    - if *highPriorityMeasRelax* is configured with value *true*:
      - the UE may choose not to perform measurement on this frequency cell(s);

- else (i.e. the serving cell fulfils Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$):
  - the UE may choose to perform relaxed measurements for NR inter-frequency cells or inter-RAT frequency cells according to relaxation methods in clauses 4.2.2.10, and 4.2.2.11 in TS 38.133 [8];
- if *cellEdgeEvaluation* is configured and *lowMobilityEvaluation* is not configured; and
- if the relaxed measurement criterion in clause 5.2.4.9.2 is fulfilled:
  - the UE may choose to perform relaxed measurements for intra-frequency cells according to relaxation methods in clauses 4.2.2.9 in TS 38.133 [8];
  - if the serving cell fulfils Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$:
    - the UE may choose to perform relaxed measurements for NR inter-frequency cells or inter-RAT frequency cells according to relaxation methods in clauses 4.2.2.10, and 4.2.2.11 in TS 38.133 [8];
- if both *lowMobilityEvaluation* and *cellEdgeEvaluation* are configured:
  - if the UE has performed normal intra-frequency, NR inter-frequency, or inter-RAT frequency measurements for at least $T_{SearchDeltaP}$ after (re-)selecting a new cell; and
  - if the relaxed measurement criterion in clause 5.2.4.9.1 is fulfilled for a period of $T_{SearchDeltaP}$; and
  - if the relaxed measurement criterion in clause 5.2.4.9.2 is fulfilled:
    - for any intra-frequency, NR inter-frequency, or inter-RAT frequency, if less than 1 hour has passed since measurements of corresponding frequency cell(s) for cell reselection were last performed:
      - the UE may choose not to perform measurement for measurements on this frequency cell(s);
  - else:
    - if the UE has performed normal intra-frequency, NR inter-frequency, or inter-RAT frequency measurements for at least $T_{SearchDeltaP}$ after (re-)selecting a new cell, and the relaxed measurement criterion in clause 5.2.4.9.1 is fulfilled for a period of $T_{SearchDeltaP}$; or,
    - if the relaxed measurement criterion in clause 5.2.4.9.2 is fulfilled:
      - if *combineRelaxedMeasCondition* is not configured:
        - the UE may choose to perform relaxed measurements for intra-frequency cells, NR inter-frequency cells of equal or lower priority, or inter-RAT frequency cells of lower priority according to relaxation methods in clauses 4.2.2.9, 4.2.2.10, and 4.2.2.11 in TS 38.133 [8];
        - if the serving cell fulfils Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$:
          - the UE may choose to perform relaxed measurement for NR inter-frequency cells of higher priority, or inter-RAT frequency cells of higher priority according to relaxation methods in clauses 4.2.2.10, and 4.2.2.11 in TS 38.133 [8];

The above relaxed measurements and no measurement are not applicable for frequencies that are included in *VarMeasIdleConfig*, if configured and for which the UE supports dual connectivity or carrier aggregation between those frequencies and the frequency of the current serving cell.

5.2.4.9.1 Relaxed measurement criterion for UE with low mobility

The relaxed measurement criterion for UE with low mobility 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 measurement 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.

5.2.4.9.2 Relaxed measurement criterion for UE not at cell edge

The relaxed measurement criterion for UE not at cell edge is fulfilled when:

- Srxlev > $S_{SearchThresholdP}$, and,
- Squal > $S_{SearchThresholdQ}$, if $S_{SearchThresholdQ}$ is configured,

Where:

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

5.2.4.10 Cell reselection with CAG cells

In addition to normal cell reselection, a UE may optionally use an autonomous search function to detect CAG cells on serving and non-serving frequencies. However UE shall follow the cell reselection criteria based on dedicated frequency priorities and only follow the autonomous cell search result if the result fulfils also the existing cell reselection criteria based on dedicated frequency priorities.

5.2.5 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 broadcast in *SIB1*;
- monitor Short Messages transmitted with P-RNTI over DCI as specified in clause 6.5 in TS 38.331 [3];
- monitor relevant System Information as specified in TS 38.331 [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 38.133 [8];
  2) When information on the BCCH used for the cell reselection evaluation procedure has been modified.

5.2.6 Selection of cell at transition to RRC_IDLE or RRC_INACTIVE state

At reception of *RRCRelease* message to transition the UE to RRC_IDLE or RRC_INACTIVE, UE shall attempt to camp on a suitable cell according to *redirectedCarrierInfo* if included in the *RRCRelease* 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 *RRCRelease* message does not contain the *redirectedCarrierInfo*, UE shall attempt to select a suitable cell on an NR carrier. If no suitable cell is found according to the above, the UE shall perform cell selection using stored information in order to find a suitable cell to camp on.

When returning to RRC_IDLE 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 *RRCRelease* 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 *RRCRelease* message does not contain *redirectedCarrierInfo* UE shall attempt to select an acceptable cell on an NR frequency. If no acceptable cell is found according to the above, the UE not in SNPN Access Mode shall continue to search for an acceptable cell of any PLMN in state *any cell selection*.

5.2.7 Any Cell Selection state

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 not in SNPN Access Mode 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 5.1.1.2.

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

5.2.8 Camped on Any Cell state

This state is only applicable for RRC_IDLE state. In this state, the UE shall perform the following tasks:

- monitor Short Messages transmitted with P-RNTI over DCI as specified in clause 6.5 in TS 38.331 [3];
- monitor relevant System Information as specified in TS 38.331 [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 38.133 [8];
  2) When information on the 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 IMS emergency calls as indicated by the field *ims-EmergencySupport* in SIB1 as specified in TS 38.331 [3], the UE shall perform cell selection/reselection to an acceptable cell that supports emergency calls in any supported RAT regardless of priorities provided in system information from current cell, if no suitable cell is found.

5.3 Cell Reservations and Access Restrictions

5.3.0 Introduction

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 Unified Access Control as specified in TS 38.331 [3], shall allow preventing selected access categories or access identities from sending initial access messages for load control reasons.

Unified Access Control does not apply to IAB-MTs.

5.3.1 Cell status and cell reservations

Cell status and cell reservations are indicated in the *MIB or SIB1* message as specified in TS 38.331 [3] by means of following fields:

- *cellBarred* (IE type: "barred" or "not barred")
  Indicated in *MIB* message. In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is common for all PLMNs and NPNs
- *cellReservedForOperatorUse* (IE type: "reserved" or "not reserved")
  Indicated in *SIB1* message. In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is specified per PLMN or per SNPN.
- *cellReservedForOtherUse* (IE type: "true")
  Indicated in *SIB1* message. In case of multiple PLMNs indicated in *SIB1*, this field is common for all PLMNs.

- *cellReservedForFutureUse* (IE type: "true")
  Indicated in *SIB1* message. In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is common for all PLMNs and NPNs.

NOTE 0: IAB-MT ignores the *cellBarred*, *cellReservedForOperatorUse*, *cellReservedForFutureUse* and *intraFreqReselection* (i.e. treats *intraFreqReselection* as if it was set to *allowed*) as defined in TS 38.331 [3]. IAB-MT also ignores *cellReservedForOtherUse* for cell barring determination (i.e. NPN capable IAB-MT considers *cellReservedForOtherUse* for determination of an NPN-only cell) as defined in TS 38.331 [3].

- *iab-Support* (IE type: "true")
  Indicated in *SIB1* message. In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is specified per PLMN or per SNPN.

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

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

When cell broadcasts any CAG-IDs or NIDs and the cell status is indicated as "not barred" and "not reserved" for operator use and "true" for other use, and not "true" for future use:

- All NPN-capable UEs shall treat this cell as candidate during the cell selection and cell reselection procedures, other UEs shall treat this cell as if cell status is "barred".

When cell status is indicated as "true" for other use, and either cell does not broadcast any CAG-IDs or NIDs or does not broadcast any CAG-IDs and the UE is not operating in SNPN Access Mode,

- The UE shall treat this cell as if cell status is "barred".

When cell status is indicated as "true" for future use,

- The UE shall treat this cell as if cell status is "barred".

When cell status is indicated as "not barred" and "reserved" for operator use for any PLMN/SNPN and not "true" for other use and not "true" for future use,

- UEs assigned to Access Identity 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 Access Identity 11 or 15 shall treat this cell as candidate during the cell selection and reselection procedures if the field *cellReservedForOperatorUse* for selected/registered SNPN is set to "reserved".

- UEs assigned to an Access Identity 0, 1, 2 and 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/SNPN or the selected PLMN/SNPN.

NOTE 1: Access Identities 11, 15 are only valid for use in the HPLMN/ EHPLMN; Access Identities 12, 13, 14 are only valid for use in the home country as specified in TS 22.261 [12].

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 select another cell 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 *MIB*:

  - 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.

- else:

  - If the field *intraFreqReselection* in *MIB* 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 *MIB* message is set to "not allowed":
  - If the cell operates in licensed spectrum or if this cell belongs to a PLMN which is indicated as being equivalent to the registered PLMN or if this cell belongs to the registered SNPN of the UE:
    - the UE shall not re-select a cell on the same frequency as the barred cell;
  - else:
    - the UE may select to another cell on the same frequency if reselection criteria are fulfilled.
  - The UE shall exclude the barred cell and, if the cell operates in licensed spectrum or if this cell belongs to a PLMN which is indicated as being equivalent to the registered PLMN, also 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.

5.3.2 Unified access control

The information on cell access restrictions associated with Access Categories and Identities is broadcast in *SIB1* as part of Unified Access Control as specified in TS 38.331 [3].

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.

The UE shall consider Access Category and Identity related cell access restrictions for NAS initiated access attempts and RNAU as specified in TS 38.331 [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.

If the UE operating in SNPN access mode reads more than one SNPN identity in the current cell, the UE shall report the found SNPN 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 [9].

5.5 RAN Area registration

The UE performs a RAN-based notification area update (RNAU) periodically or when the UE selects a cell that does not belong to the configured RNA.

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 and RRC_INACTIVE. The changes in the system information are notified by the network using a Short Message as specified in TS 38.331 [3]. When the Short Message notifies system information changes, then the UE shall acquire or re-acquire the concerned system information as specified in TS 38.331 [3].

7 Paging

7.1 Discontinuous Reception for paging

The UE may use Discontinuous Reception (DRX) in RRC_IDLE and RRC_INACTIVE state in order to reduce power consumption. The UE monitors one paging occasion (PO) per DRX cycle. A PO is a set of PDCCH monitoring occasions and can consist of multiple time slots (e.g. subframe or OFDM symbol) where paging DCI can be sent (TS 38.213 [4]). One Paging Frame (PF) is one Radio Frame and may contain one or multiple PO(s) or starting point of a PO.

In multi-beam operations, the UE assumes that the same paging message and the same Short Message are repeated in all transmitted beams and thus the selection of the beam(s) for the reception of the paging message and Short Message is up to UE implementation. The paging message is same for both RAN initiated paging and CN initiated paging.

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

The PF and PO for paging are determined by the following formulae:

SFN for the PF is determined by:

(SFN + PF_offset) mod T = (T div N)*(UE_ID mod N)

Index (i_s), indicating the index of the PO is determined by:

i_s = floor (UE_ID/N) mod Ns

The PDCCH monitoring occasions for paging are determined according to *pagingSearchSpace* as specified in TS 38.213 [4] and *firstPDCCH-MonitoringOccasionOfPO* and *nrofPDCCH-MonitoringOccasionPerSSB-InPO* if configured as specified in TS 38.331 [3]. When *SearchSpaceId* = 0 is configured for *pagingSearchSpace*, the PDCCH monitoring occasions for paging are same as for RMSI as defined in clause 13 in TS 38.213 [4].

When *SearchSpaceId* = 0 is configured for *pagingSearchSpace*, Ns is either 1 or 2. For Ns = 1, there is only one PO which starts from the first PDCCH monitoring occasion for paging in the PF. For Ns = 2, PO is either in the first half frame (i_s = 0) or the second half frame (i_s = 1) of the PF.

When *SearchSpaceId* other than 0 is configured for *pagingSearchSpace*, the UE monitors the $(i\_s + 1)^{th}$ PO. A PO is a set of 'S*X ' consecutive PDCCH monitoring occasions where 'S' is the number of actual transmitted SSBs determined according to *ssb-PositionsInBurst* in *SIB1* and X is the *nrofPDCCH-MonitoringOccasionPerSSB-InPO* if configured or is equal to 1 otherwise. The $[x*S+K]^{th}$ PDCCH monitoring occasion for paging in the PO corresponds to the K^{th} transmitted SSB, where x=0,1,…,X-1, K=1,2,…,S. The PDCCH monitoring occasions for paging which do not overlap with UL symbols (determined according to *tdd-UL-DL-ConfigurationCommon*) are sequentially numbered from zero starting from the first PDCCH monitoring occasion for paging in the PF. When *firstPDCCH-MonitoringOccasionOfPO* is present, the starting PDCCH monitoring occasion number of $(i\_s + 1)^{th}$ PO is the $(i\_s + 1)^{th}$ value of the *firstPDCCH-MonitoringOccasionOfPO* parameter; otherwise, it is equal to i_s * S*X. If X > 1, when the UE detects a PDCCH transmission addressed to P-RNTI within its PO, the UE is not required to monitor the subsequent PDCCH monitoring occasions for this PO.

NOTE 1: A PO associated with a PF may start in the PF or after the PF.

NOTE 2: The PDCCH monitoring occasions for a PO can span multiple radio frames. When *SearchSpaceId* other than 0 is configured for *paging-SearchSpace* the PDCCH monitoring occasions for a PO can span multiple periods of the paging search space.

The following parameters are used for the calculation of PF and i_s above:

T: DRX cycle of the UE (T is determined by the shortest of the UE specific DRX value(s), if configured by RRC and/or upper layers, and a default DRX value broadcast in system information. In RRC_IDLE state, if UE specific DRX is not configured by upper layers, the default value is applied).

N: number of total paging frames in T

Ns: number of paging occasions for a PF

PF_offset: offset used for PF determination

UE_ID: 5G-S-TMSI mod 1024

Parameters *Ns*, *nAndPagingFrameOffset*, *nrofPDCCH-MonitoringOccasionPerSSB-InPO*, and the length of default DRX Cycle are signaled in *SIB1*. The values of N and PF_offset are derived from the parameter *nAndPagingFrameOffset* as defined in TS 38.331 [3]. The parameter *first-PDCCH-MonitoringOccasionOfPO* is signalled in *SIB1* for paging in initial DL BWP. For paging in a DL BWP other than the initial DL BWP, the parameter *first-PDCCH-MonitoringOccasionOfPO* is signaled in the corresponding BWP configuration.

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.

5G-S-TMSI is a 48 bit long bit string as defined in TS 23.501 [10]. 5G-S-TMSI shall in the formulae above be interpreted as a binary number where the left most bit represents the most significant bit.

8 Sidelink Operation

8.1 NR sidelink communication and V2X sidelink communication

The UE may transmit or receive NR sidelink communication if it fulfils the condition(s) defined in TS 38.331 [3], clause 5.8.2. When UE is in-coverage for sidelink operation as defined in clause 8.2, the UE may perform NR sidelink communication according to *SystemInformationBlockType12*, and when out-of-coverage for sidelink, the UE may perform NR sidelink communication according to *SL-V2X-PreconfigurationNR* or according to *SystemInformationBlockType12* of the cell on the frequency which provides inter-carrier NR sidelink configuration, as specified in TS 38.331 [3]. The UE shall not perform NR sidelink communication according to *SL-V2X-PreconfigurationNR* if the UE detects a cell providing NR sidelink configuration or inter-carrier NR sidelink configuration for the frequency UE is interested to perform NR sidelink communication on.

The UE may transmit or receive V2X sidelink communication if it fulfills the condition(s) defined in TS 36.331[6], clause 5.10.1d. When UE is in-coverage for sidelink operation as defined in clause 8.2, the UE may perform V2X sidelink communication according to *SystemInformationBlockType13/SystemInformationBlockType14* of the cell on an NR frequency.

8.2 Cell selection and reselection for Sidelink

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

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 reselection purpose in accordance with TS 38.133[8]. 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 38.133[8].

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 8.2.1, 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 detects at least one cell on the frequency which UE is configured to perform V2X sidelink communication on fulfilling the S criterion in accordance with clause 8.2.1, it shall consider itself to be in-coverage for V2X 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 V2X sidelink communication on that frequency.

If the UE has selected a cell on a non-serving frequency for V2X sidelink communication, it shall perform additional intra-frequency reselection process to select a better cell for sidelink operation on that frequency in accordance with clause 8.2.1.

If the UE has selected a cell on a non-serving frequency for NR sidelink communication, it shall perform additional reselection process to select a better cell for sidelink operation in accordance with clause 8.2.1.

8.2.1 Parameters used for cell selection and reselection triggered for sidelink

When evaluating S criterion, R criterion (ranking) or inter-frequency cell reselection criterion, as defined in clause 5.2.3.2, clause 5.2.4.6 and clause 5.2.4.5 respectively, for cell selection/reselection triggered for NR sidelink communication or V2X sidelink communication on a non-serving frequency, UE shall perform the evaluation as follows:

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

Annex A (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
3/2017						Initial skeleton	0.0.1
5/2017						Updated initial skeleton	0.0.2
6/2017						Updated based on RAN2#98 agreements	0.0.3
8/2017						Updated based on feedback from companies	0.0.4
10/2017						No changes	0.0.5
11/2017						No changes	0.0.6
01/2018						No changes	0.0.7
01/2018						No changes	0.1.0
02/2018						Updated based on RAN-NR-AH1801 agreements	0.1.1
02/2018						No changes	0.1.2
03/2018						Updated based on RAN#101 agreements	0.2.0
03/2018	RAN#79	RP-180451				Typo corrections; submitted to RAN#79 for information	1.0.0
04/2018	RAN2#101bis	R2-1805086				No changes	1.0.1
05/2018	RAN2#102	R2-1806884				Updated based on RAN2#101bis agreements	1.1.0
06/2018		R2-1809262				Updated based on RAN2#102 agreements	1.2.0
06/2018	RP#80	RP-180694				Submitted to RAN#80 for approval	2.0.0
06/2018						Upgraded to Rel-15 after the plenary approval	15.0.0
09/2018	RP-81	RP-181941	0024	2	F	Miscellaneous Corrections based on endorsed CRs in RAN2#103	15.1.0
12/2018	RP-82	R2-1818509	0047	4	F	Clarification of Paging Monitoring Occasion	15.2.0
	RP-82	R2-1816301	0049	2	F	Correction to description of PO for default association	15.2.0
	RP-82	R2-1819196	0051	3	F	Corrections on 38.304	15.2.0
	RP-82	R2-1816678	0055	2	F	CR on PDCCH monitoring occasions for paging	15.2.0
	RP-82	R2-1817200	0056	2	F	Release and Redirect in 2-step procedure	15.2.0
	RP-82	R2-1818681	0062	4	F	Clarification on final suitability check	15.2.0
	RP-82	R2-1817261	0063	2	D	Correction to Ambiguous Terminologies with respect to Cell Ranking	15.2.0
	RP-82	R2-1818125	0066	2	F	Correction on definition of PEMAX1, PEMAX2	15.2.0
	RP-82	R2-1817662	0067	2	F	Clarification of mobility state detection criteria	15.2.0
	RP-82	R2-1818549	0074	2	F	CR on UE behaviour upon lack of TAC in SIB1	15.2.0
	RP-82	R2-1818508	0075	1	F	Miscellaneous Corrections in Paging	15.2.0
	RP-82	R2-1819037	0076	1	F	Clarification for the UE behaviour in camped normally and camped on any cell states	15.2.0
	RP-82	R2-1818883	0079	2	F	Corrections on storing and discarding UE AS context	15.2.0
	RP-82	R2-1818998	0084	2	F	Correction to UE behavior for barred cell	15.2.0
	RP-82	R2-1817141	0087	-	F	Clarification on cell reselection conditions during TreselectionRAT	15.2.0
	RP-82	R2-1818881	0088	2	F	Introduction of MICO mode	15.2.0
	RP-82	R2-1817145	0089	-	F	Correction to monitoring paging in Camped on Any Cell state	15.2.0
	RP-82	R2-1818878	0090	1	F	Minor clarifications for paging	15.2.0
	RP-82	R2-1818688	0096	1	F	Correction to cell access barring alleviation in cell reselection	15.2.0
	RP-82	R2-1818683	0097	1	F	CR on 38.304 corrections	15.2.0
	RP-82	R2-1817738	0099	-	F	38.304 CR on derivation of N for paging	15.2.0
	RP-82	R2-1819026	0102	1	F	Correction of PLMN selection in RRC_INACTIVE	15.2.0
03/2019	RP-83	RP-190540	0081	4	F	CR on UE behavior if emergency call is not supported in the current cell	15.3.0
	RP-83	RP-190540	0103	2	F	Correction to number of radio frames spanned by PDCCH monitoring occasions of a PO	15.3.0
	RP-83	RP-190540	0104	1	F	Correction to signaling aspects of parameter first-PDCCH-MonitoringOccasionOfPO	15.3.0
	RP-83	RP-190540	0111	-	F	Clarification for paging and UL symbols	15.3.0
	RP-83	RP-190544	0113	3	F	Miscellaneous Corrections	15.3.0
	RP-83	RP-190544	0117	1	F	Correction on exception to cell categories for regional provision of service	15.3.0
06/2019	RP-84	RP-191373	0120	-	F	UE behavior on cell reselection if rangeToBestCell is configured_Option 2	15.4.0
	RP-84	RP-191373	0121	-	F	Miscellaneous Corrections	15.4.0
	RP-84	RP-191374	0125	-	F	CR on inter-RAT cell reselection	15.4.0
	RP-84	RP-191376	0126	1	F	UE behaviour on the cell without TAC	15.4.0
	RP-84	RP-191376	0128	1	F	Correction for Access Identity 0 when PLMN is reserved for operator use	15.4.0
	RP-84	RP-191376	0132	1	F	Monitoring of short messages with multi-beams	15.4.0
09/2019	RP-85	RP-192193	0136	2	F	Miscellaneous Corrections	15.5.0
12/2019	RP-86	RP-192936	0139	2	F	Miscellaneous Corrections	15.6.0
	RP-86	RP-192938	0143	1	F	Correction to Pcompensation for FR2	15.6.0
03/2020	RP-87	RP-200344	0145	4	B	Introduction of UE Power Saving in NR	16.0.0
	RP-87	RP-200353	0148	2	B	Introduction of PRN for TS 38.304	16.0.0
	RP-87	RP-200341	0149	2	B	Introduction of NR operation with Shared Spectrum Access in Idle/Inactive mode	16.0.0
	RP-87	RP-200349	0150	3	B	Correction of TS 38.304 to introduce IAB	16.0.0

	RP-87	RP-200346	0151	1	B	CR on cell selection/ reselection for NR V2X UE	16.0.0
07/2020	RP-88	RP-201179	0153	4	F	Miscellaneous correction to 38.304 for IAB	16.1.0
	RP-88	RP-201165	0155	4	A	Corrections to cell barred handling	16.1.0
	RP-88	RP-201182	0156	3	F	Corrrection to 38.304 for PRN	16.1.0
	RP-88	RP-201179	0157	4	B	Corrections to 38.304 for supporting IAB in NPN	16.1.0
	RP-88	RP-201174	0158	1	B	CR for UE Power Saving in NR	16.1.0
	RP-88	RP-201190	0173	-	C	Introduction of eCall over IMS for NR	16.1.0
	RP-88	RP-201176	0174	2	F	CR on cell (re)selection for sidelink in TS 38.304	16.1.0
09/2020	RP-89	RP-201927	0175	1	F	Correction to TS 38.304	16.2.0
	RP-89	RP-201932	0184	1	D	Miscellaneous corrections (Rapporteur)	16.2.0
	RP-89	RP-201923	0185	-	F	Miscellaneous corrections for TS 38.304 for IAB	16.2.0
	RP-89	RP-201929	0186	1	F	CR for UE Power Saving in NR	16.2.0
	RP-89	RP-201928	0187	-	F	Idle mode corrections for NPN	16.2.0
12/2020	RP-90	RP-202776	0193	1	F	Correction on RRM relaxation	16.3.0
	RP-90	RP-202771	0195	-	F	Miscellaneous Corrections	16.3.0
	RP-90	RP-202769	0196	-	F	Correction on inter-frequency operation	16.3.0

History

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