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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).

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