**3GPP TSG-RAN WG2 Meeting #109 electronic            R2-2002318**

**Elbonia, 24th Feb – 6th Mar 2020**

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| *For* ***[HELP](http://www.3gpp.org/3G_Specs/CRs.htm%22%20%5Cl%20%22_blank)*** *on using this form: comprehensive instructions can be found at <http://www.3gpp.org/Change-Requests>.* |
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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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|  |
| ***Title:***  | CR on cell selection/ reselection for NR V2X UE |
|  |  |
| ***Source to WG:*** | ZTE Corporation, Sanechips |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | 5G\_V2X\_NRSL |  | ***Date:*** | 2019-03-05 |
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| ***Category:*** | **B** |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-12 (Release 12)Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
|  |  |
| ***Reason for change:*** | Cell selection/ reselection for UE of 5G V2X with NR sidelink should be added into TS38.304 |
|  |  |
| ***Summary of change:*** | * New abbreviations and definitions are added to 3
* New section x is added for sidelink operation.
* New section x.1 is added for NR sidelink communication and V2X sidelink communication
* New section x.2 is added for NR V2X cell selection/reselection
* RAN2#106 agreements are captured
* RAN2#107 agreements are captured
* RAN2#108 email discussion#103 results are captured
* RAN2#109e agreements are captured.
 |
|  |  |
| ***Consequences if not approved:*** | Cell selection/reselection for 5G V2X with NR Sidelink will not be introduced in Rel-16. |
|  |  |
| ***Clauses affected:*** | 1/2/3.1/3.2/4.1/4.5/5.2.4.1/X.1/X.2 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ...,CR…  |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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START OF THE CHANGE

Contents

Foreword 5

1 Scope 6

2 References 6

3 Definitions, symbols and abbreviations 7

3.1 Definitions 7

3.2 Abbreviations 7

4 General description of RRC\_IDLE state and RRC\_INACTIVE state 8

4.1 Overview 8

4.2 Functional division between AS and NAS in RRC\_IDLE state and RRC\_INACTIVE state 9

4.3 Service types in RRC\_IDLE state 12

4.4 Service types in RRC\_INACTIVE state 12

4.5 Cell Categories 12

5 Process and procedure descriptions 13

5.1 PLMN selection 13

5.1.1 Support for PLMN selection 13

5.1.1.1 General 13

5.1.1.2 NR case 13

5.1.1.3 E-UTRA case 13

5.2 Cell selection and reselection 13

5.2.1 Introduction 13

5.2.2 States and state transitions in RRC\_IDLE state and RRC\_INACTIVE state 15

5.2.3 Cell Selection process 16

5.2.3.1 Description 16

5.2.3.2 Cell Selection Criterion 16

5.2.3.3 E-UTRAN case in Cell Selection 17

5.2.4 Cell Reselection evaluation process 17

5.2.4.1 Reselection priorities handling 17

5.2.4.2 Measurement rules for cell re-selection 18

5.2.4.3 Mobility states of a UE 18

5.2.4.3.0 Introduction 18

5.2.4.3.1 Scaling rules 19

5.2.4.4 Cells with cell reservations, access restrictions or unsuitable for normal camping 20

5.2.4.5 NR Inter-frequency and inter-RAT Cell Reselection criteria 20

5.2.4.6 Intra-frequency and equal priority inter-frequency Cell Reselection criteria 21

5.2.4.7 Cell reselection parameters in system information broadcasts 21

5.2.4.7.0 General reselection parameters 21

5.2.4.7.1 Speed dependent reselection parameters 23

5.2.4.8 Inter-RAT Cell reselection in RRC\_INACTIVE state 24

5.2.5 Camped Normally state 24

5.2.6 Selection of cell at transition to RRC\_IDLE or RRC\_INACTIVE state 24

5.2.7 Any Cell Selection state 24

5.2.8 Camped on Any Cell state 24

5.3 Cell Reservations and Access Restrictions 25

5.3.0 Introduction 25

5.3.1 Cell status and cell reservations 25

5.3.2 Unified access control 26

5.4 Tracking Area registration 26

5.5 RAN Area registration 26

6 Reception of broadcast information 26

6.1 Reception of system information 26

7 Paging 27

7.1 Discontinuous Reception for paging 27

Annex A (informative): Change history 29

# Foreword

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

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

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

# 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".

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

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

# 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.

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

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

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

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

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

**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.

**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].

**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.

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

**Sidelink:** UE to UE interface for V2X sidelink communication defined in TS 23.287[xx].

**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].

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

**V2X sidelink communication**: AS functionality enabling V2X Communication as defined in TS 23.285 [xy], 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

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

IMSI International Mobile Subscriber Identity

MCC Mobile Country Code

MICO Mobile Initiated Connection Only

NAS Non-Access Stratum

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

UAC Unified Access Control

UE User Equipment

UMTS Universal Mobile Telecommunications System

V2X Vehicle to Everything

NEXT CHANGE

# 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;

- Cell selection and reselection;

- Location registration and RNA update.

PLMN 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, 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) is selected by NAS. For the selected PLMN, 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, 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 then becomes the registered PLMN, 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.

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

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 X.

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.

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.

NEXT CHANGE

## 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:**

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;

- 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" (TS 22.261 [12]), which belongs to a PLMN that fulfils the first bullet above.

**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 registration area that is forbidden for regional provision of service; a cell that belongs to a registration 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 [xx, 5.7], the UE may perform NR sidelink communication or V2X sidelink communication.

NEXT CHANGE

# 5 Process and procedure descriptions

## 5.2 Cell selection and reselection

### 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 only NR sidelink communication, the UE may consider the frequency providing NR sidelink communication configuration to be the highest priority. If the UE is configured to perform only V2X sidelink communication, the UE may consider the frequency providing V2X sidelink communication configuration to be the highest priority.

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

NOTE W: 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 L: 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 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

- a PLMN 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 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.

NEXT CHANGE

# X Sidelink Operation

## X.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, x.x.x]. When UE is in-coverage for sidelink operation as defined in clause X, the UE may perform NR sidelink communication according to *SystemInformationBlockTypeXX,* and when out-of-coverage for sidelink, the UE may perform NR sidelink communication according to *SL-V2X-PreconfigurationNR* or according to *SystemInformationBlockTypeXX* 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[xy, x.x.x]. When UE is in-coverage for sidelink operation as defined in clause X,2, the UE may perform V2X sidelink communication according to *SystemInformationBlockType Xx* of the cell on an NR frequency.

## X.2 Cell selection and reselection for Sidelink

The UE may perform cell selection in accordance with clause 5.2.7.

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 X.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 X.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.

### X.2.1 Parameters used for cell selection and reselection triggered for sidelink

When evaluating S criterion or R criterion (ranking), as defined in clause 5.2.3.2 and clause 5.2.4.6 respectively, for cell selection/reselection triggered for 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.

END OF THE CHANGE