**3GPP TSG-RAN WG2 Meeting #115eR2-210xxx**

Online, 9 – 27 August 2021

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **38.304** | **CR** | **Draft** | **rev** | **-** | **Current version:** | **16.5.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](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:***  | Draft CR for Enhancements for Private Networks |
|  |  |
| ***Source to WG:*** | Qualcomm Incorporated |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NG\_RAN\_PRN\_enh-Core |  | ***Date:*** | 2021-9-06 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-17 |
|  | *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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | Introduce the Idle/Inactive mode related changes for Rel-17 Enhancements for Private Networks. |
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| ***Summary of change:*** | * Add GIN as an abbreviation in 3.2
* Add reception of credentials holder and onboarding indicators as well as the list of GINs to PLMN selection in Section 4.2 and 5.1.
* Extend “acceptable cell” concept to SNPNs in Section 4.5, 5.2.6, and 5.2.8
* Add emergency support for SNPN in Section 5.2.8
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| ***Consequences if not approved:*** | Enhancements for Private Networks will not be supported in 38.304. |
|  |  |
| ***Clauses affected:*** | 3.2, 4.2, 4.5, 5.1, 5.2.6, 5.2.7, 5.2.8 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

*Start of Changes*

## 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

GIN Group ID for Network selection

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

*Next Change*

## 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 and SNPN 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; report information related to SNPN access with subscription of a different Credentials Holder, indicator whether onboarding is enabled, and the list of supported GINs to NAS autonomously, as specified in TS 38.300 [2].**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. |
| 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. |

*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:**

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/SNPN 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.

*Next Change*

## 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 UE may also optionally receive indicators for whether access using credentials from a separate entity is supported, whether the SNPN allows registration attempts from UEs that are not explicitly configured to select the SNPN, and whether onboarding is enabled; the UE may also optionally receive a list of supported Group IDs for Network selection (see TS 38.300 [2]). The result of the SNPN selection performed by NAS (see TS 23.122 [9]) is an identifier of the selected SNPN.

*Next Change*

### 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*. If no acceptable cell is found according to the above, the UE in SNPN access mode shall continue to search for an acceptable cell of any SNPN 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. If the cell selection process fails to find a suitable cell after a complete scan of all frequency bands supported by the UE, the UE in SNPN access mode shall attempt to find an acceptable cell of any SNPN to camp on.

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, the UE is not in SNPN access mode, 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.

- if the UE supports voice services, the UE is in SNPN access mode, and the current cell does not support IMS emergency calls as indicated by the field *ims-SNPN-EmergencySupport* in SIB1 as specified in TS 38.331 [3], the UE shall perform cell selection/reselection to an acceptable cell of any available SNPN that supports emergency calls, if no suitable cell is found.

Editor’s Note: The name of the new field for Emergency Support for SNPN in SIB1 is TBD. It is FFS if this field is per cell or per SNPN.

*End of Changes*

# Annex A: RAN2 Agreements (to be removed when the CR is submitted)

## A.1 RAN2#113

Agreements on Support SNPN with subscription or credentials by a separate entity were as follows:

* A new indicator that "access using credentials from a separate entity is supported" is broadcasted, and the indicator is broadcasted per SNPN in network sharing scenarios.
* RAN2 assumes that the new indicator that "access using credentials from a separate entity is supported" is broadcasted in SIB1.
* The supported Group IDs are broadcasted
* A new indicator that "whether the SNPN allows registration attempts from UEs that are not explicitly configured to select the SNPN" is broadcasted, and the indicator is broadcasted per SNPN in network sharing scenario.
* RAN2 assumes that the new indicator that "whether the SNPN allows registration attempts from UEs that are not explicitly configured to select the SNPN" is broadcasted in SIB1.
* In the UE, AS reports to NAS about the following broadcasted new parameters:

Indicator that "access using credentials from a separate entity is supported" in the cell per SNPN

Supported Group IDs

Indicator that "whether the SNPN allows registration attempts from UEs that are not explicitly configured to select the SNPN" per SNPN.

Agreements on Support UE onboarding and provisioning for NPN were as follows:

* Broadcast a 1-bit indication for onboarding per O-SNPN.
* R2 assumes that the 1-bit indication for onboarding is in SIB1.
* The UE sends an indication for onboarding to the gNB at RRC Connection Establishment (intention to support AMF selection).
* Focus on the O-SNPN scenario. Wait for SA2 further conclusion on how a PLMN can be used as onboarding network.

Agreements on IMS voice and emergency services for SNPN were as follows:

* Extend the ims-EmergencySupport field to SNPN cells (it is FFS whether to reuse the existing IE or add new IEs indicating the support for IMS emergency).
* For reserved cells specified in TS 38.304, all acceptable cells of an SNPN supporting emergency services are treated as suitable when the UE has an ongoing emergency call.
* R17 UEs in SNPN Access Mode can camp on an acceptable SNPN cell supporting emergency services to obtain emergency services.
* The voiceFallbackIndication field in RRCRelease and MobilityFromNRCommand is not applicable to SNPN cells.

## A.2 RAN2#113bis Agreements

General agreements were as follows:

support of PWS over SNPN:

* It seems feasible to do this in R17 from R2 persepctive. Very small impact foreseen

Agreements on Support SNPN with subscription or credentials by a separate entity were as follows:

* Use the term "Credentials Holder (CH)" in future RAN2 discussions for the external entity providing subscription or credential for SNPNs.
* Use the term "Group IDs for Network Selection (GINs)" in future RAN2 discussions for the service provider Group IDs.
* The following assumptions in last meeting are confirmed as agreements,

The new indicator that "access using credentials from a separate entity is supported" is broadcasted in SIB1.

The new indicator that "whether the SNPN allows registration attempts from UEs that are not explicitly configured to select the SNPN" is broadcasted in SIB1.

* GIDs are broadcasted per SNPN in network sharing scenarios.
* RAN2 to revise the previous agreement as following:

In the UE, AS reports broadcast Group IDs per SNPN to NAS.

* To supporting SNPN with subscription or credentials by a separate entity, R2 assumes that there is no impact on cell (re)selection (e.g. no need to change suitable cell criteria).

Agreements on Support UE onboarding and provisioning for NPN were as follows:

* UE AS forwards the onboarding indication (and Group IDs if Proposal#1 is agreed) per SNPN to UE NAS for onboarding network selection.
* No UE impact on connected mode mobility for onboarding.
* A new onboarding indication is included in *RRCSetupComplete* message.
* R2 assumes that no enhancement is needed to support onboarding for provisioning the PNI-NPN credentials to UE.
* There is no need to introduce an onboarding request indication in RRC messages for UEs in RRC\_INACTIVE.
* Group IDs per SNPN for onboarding purpose is broadcast in the SIB. FFS whether the Group IDs for onboarding purpose and for credential by separate entity are different.
* R2 assumes that onboarding will not impact cell reselection.

## A.3 RAN2#114 Agreements

General agreements were as follows:

Reply for LS on limited service availability of an SNPN (C1-21212601/R2-2104704):

* We reply “YES” (to Q1 of the LS), but need to discuss the details of the additional info and the alternatives.

Agreements on Support SNPN with subscription or credentials by a separate entity were as follows:

* GIN for access using CH is broadcst only if Indication of accessing using CH is broadcast.
* RAN2 assumes that NAS does not send selected GINs and two indications related to external credentials to AS.
* There is no impact on cell (re)selection to support SNPN with subscription or credentials by a separate entity.
* RAN2 assume there is no RAN2 UE impact of connected mode mobility for separate credential.
* RAN2 assumes the selected SNPN ID is enough for AMF selection for separate credential.
* GIN is broadcasted by new SIB

Agreements on Support UE onboarding and provisioning for NPN were as follows:

* No additional information except for the already agreed broadcast parameters is needed, unless requested by other WG.
* There is no need to introduce the 1-bit onboarding indication in SIB1 and optional GINs for PLMNs acting as onboarding networks.
* Toggling the 1-bit onboarding indication in SIB1 allows to control congestion due to onboarding request.
* RAN2 confirms that onboarding does not impact the cell reselection procedure.
* For AMF routing, no extra information is needed in addition to the already agreed onboarding request indication in RRCSetupComplete, unless explicitly requested by other WGs.
* Any limitation to a selected set of UEs using uSIM tags is out of RAN2 scope.
* Send an LS to SA2 to ask about separate or joint GIN list for onboarding and separate credentials and GIN encoding.

## A.3 RAN2#115 Agreements

Agreements on Support SNPN with subscription or credentials by a separate entity and onboarding were as follows:

* Wait for SA2 reply LS on the issue whether a common list of GINs used for onboarding and SNPN access using external credentials.
* RAN2 has not identified a need for modification of / addition to broadcast of HRNNs.
* RAN2 confirms that there is no impact on connected mode mobility when accessing an SNPN through CHs (was already assumed).
* maximum number of GINs is specified per cell
* new SIB specified to broadcast GINs acc to Option B: Single list of GINs with explicit assignment to SNPNs. Details on the explicit assignment are FFS.
* RAN2 didn’t identify a need for modification to access control for SNPN access using external credential (could be discussed in other groups)
* RAN2 didn’t identify a need for modification to access control for SNPN access for onboarding (could be discussed in other groups)

Agreements on IMS voice and emergency services for SNPN were as follows:

* Introduce a new IE/field to indicate the support of IMS emergency service for SNPN.
* eCall over IMS is not supported in SNPNs in Rel-17.
* PWS can be supported in SNPNs in Rel-17.