**3GPP TSG-SA WG2 Meeting #137E *S2-2001845***

**24-27 February 2020, Electronic Meeting**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **23.501** | **CR** | **1482** | **rev** | **6** | **Current version:** | **16.3.0** |  |
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| *For* [***HELP***](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 | **X** |

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|  |
| ***Title:***  | Alignments and corrections to Non-Public Network functionality |
|  |  |
| ***Source to WG:*** | Ericsson, Nokia, Nokia Shanghai Bell, NTT DOCOMO |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | Vertical\_LAN |  | ***Date:*** | 2020-02-17 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***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)* |
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| ***Reason for change:*** | Missing abbreviation for Public network integrated NPN.Notes with statements that something will be specified should not be needed as it can be assumed it will be (and e.g. 23.122 already been updated).Unclear if UAC information is to be provided with subscription information to the UE.Unclear if UE required to have subscription for PLMN when accessing Public network integrated NPN.Unclear if the statement "Different PLMN IDs (or combinations of PLMN ID and NID) can also point to the same 5GC" implies equivalent SNPNs are allowed or even GWCN sharing is supported. |
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| ***Summary of change:*** | Added abbreviation for Public Network Integrated NPN.Avoided "will be specified" statements.Clarified that UAC information provided to the UE as described in 24.501.Clarified that the UE is required to have subscription for PLMN when accessing Public network integrated NPN.Clarified that an SNPN does not support multiple PLMN ID and NIDs.Clarified "or combinations of PLMN ID and NID" to be AMF supporting multiple NIDs but used for different UEs i.e. not for equivalent SNPNs.Clarified SNPNClarified sharing of 5GCReverted sharing statement that PLMN ID and NID can point to same 5GCModified clarification of SNPNClarified that CAG is used for access control at cell selection.Reverted changes on CAG cell broadcast.Logic whether NG-RAN or AMF is triggering the AN release is updated, i.e. NG-RAN controls AN release when UE in CM-CONNECTED and checks CAG information when NG-RAN receives Mobility Restrictions, and AMF otherwise. |
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| ***Consequences if not approved:*** | Stage 3 WGs may implement functionality not really required by stage 2, e.g. equivalent SNPNs, or allowing UE to not have PLMN subscription when using PNI-NPN. |
|  |  |
| ***Clauses affected:*** | 3.2, 5.18.1, 5.30.1, 5.30.2.4, 5.30.2.5, 5.30.2.6, 5.30.3.1, 5.30.3.3, 5.30.3.4 |
|  |  |
|  | **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 ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | " |

\*\*\* BEGIN 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].

5GC 5G Core Network

5GLAN 5G Local Area Network

5GS 5G System

5G-AN 5G Access Network

5G-EIR 5G-Equipment Identity Register

5G-GUTI 5G Globally Unique Temporary Identifier

5G-BRG 5G Broadband Residential Gateway

5G-CRG 5G Cable Residential Gateway

5G-RG 5G Residential Gateway

5G-S-TMSI 5G S-Temporary Mobile Subscription Identifier

5QI 5G QoS Identifier

AF Application Function

AMF Access and Mobility Management Function

AS Access Stratum

ATSSS Access Traffic Steering, Switching, Splitting

ATSSS-LL ATSSS Low-Layer

AUSF Authentication Server Function

BSF Binding Support Function

CAG Closed Access Group

CAPIF Common API Framework for 3GPP northbound APIs

CHF Charging Function

CN PDB Core Network Packet Delay Budget

CP Control Plane

DL Downlink

DN Data Network

DNAI DN Access Identifier

DNN Data Network Name

DRX Discontinuous Reception

DS-TT Device-side TSN translator

ePDG evolved Packet Data Gateway

EBI EPS Bearer Identity

EUI Extended Unique Identifier

FAR Forwarding Action Rule

FN-BRG Fixed Network Broadband RG

FN-CRG Fixed Network Cable RG

FN-RG Fixed Network RG

FQDN Fully Qualified Domain Name

GFBR Guaranteed Flow Bit Rate

GMLC Gateway Mobile Location Centre

GPSI Generic Public Subscription Identifier

GUAMI Globally Unique AMF Identifier

HR Home Routed (roaming)

IAB Integrated access and backhaul

I-SMF Intermediate SMF

LADN Local Area Data Network

LBO Local Break Out (roaming)

LMF Location Management Function

LoA Level of Automation

LPP LTE Positioning Protocol

LRF Location Retrieval Function

MCX Mission Critical Service

MDBV Maximum Data Burst Volume

MFBR Maximum Flow Bit Rate

MICO Mobile Initiated Connection Only

MPS Multimedia Priority Service

MPTCP Multi-Path TCP Protocol

N3IWF Non-3GPP InterWorking Function

N5CW Non-5G-Capable over WLAN

NAI Network Access Identifier

NEF Network Exposure Function

NF Network Function

NGAP Next Generation Application Protocol

NID Network identifier

NPN Non-Public Network

NR New Radio

NRF Network Repository Function

NSI ID Network Slice Instance Identifier

NSSAA Network Slice-Specific Authentication and Authorization

NSSAI Network Slice Selection Assistance Information

NSSF Network Slice Selection Function

NSSP Network Slice Selection Policy

NW-TT Network-side TSN translator

NWDAF Network Data Analytics Function

PCF Policy Control Function

PDR Packet Detection Rule

PDU Protocol Data Unit

PEI Permanent Equipment Identifier

PER Packet Error Rate

PFD Packet Flow Description

PNI-NPN Public Network Integrated Non-Public Network

PPD Paging Policy Differentiation

PPF Paging Proceed Flag

PPI Paging Policy Indicator

PSA PDU Session Anchor

QFI QoS Flow Identifier

QoE Quality of Experience

RACS Radio Capabilities Signalling optimisation

(R)AN (Radio) Access Network

RG Residential Gateway

RIM Remote Interference Management

RQA Reflective QoS Attribute

RQI Reflective QoS Indication

RSN Redundancy Sequence Number

SA NR Standalone New Radio

SBA Service Based Architecture

SBI Service Based Interface

SCP Service Communication Proxy

SD Slice Differentiator

SEAF Security Anchor Functionality

SEPP Security Edge Protection Proxy

SMF Session Management Function

SMSF Short Message Service Function

SN Sequence Number

SNPN Stand-alone Non-Public Network

S-NSSAI Single Network Slice Selection Assistance Information

SSC Session and Service Continuity

SSCMSP Session and Service Continuity Mode Selection Policy

SST Slice/Service Type

SUCI Subscription Concealed Identifier

SUPI Subscription Permanent Identifier

SV Software Version

TAC IMEI Type Allocation Code

TNAN Trusted Non-3GPP Access Network

TNAP Trusted Non-3GPP Access Point

TNGF Trusted Non-3GPP Gateway Function

TNL Transport Network Layer

TNLA Transport Network Layer Association

TSC Time Sensitive Communication

TSN Time Sensitive Networking

TSP Traffic Steering Policy

UCMF UE radio Capability Management Function

UDM Unified Data Management

UDR Unified Data Repository

UDSF Unstructured Data Storage Function

UL Uplink

UL CL Uplink Classifier

UPF User Plane Function

URLLC Ultra Reliable Low Latency Communication

URRP-AMF UE Reachability Request Parameter for AMF

URSP UE Route Selection Policy

VID VLAN Identifier

VLAN Virtual Local Area Network

W-5GAN Wireline 5G Access Network

W-5GBAN Wireline BBF Access Network

W-5GCAN Wireline 5G Cable Access Network

W-AGF Wireline Access Gateway Function

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## 5.18 Network Sharing

### 5.18.1 General concepts

A network sharing architecture shall allow multiple participating operators to share resources of a single shared network according to agreed allocation schemes. The shared network includes a radio access network. The shared resources include radio resources.

The shared network operator allocates shared resources to the participating operators based on their planned and current needs and according to service level agreements.

In this Release of the specification, only the 5G Multi-Operator Core Network (5G MOCN) network sharing architecture, in which only the RAN is shared in 5G System, is supported. 5G MOCN for 5G System, including UE, RAN and AMF, shall support operators' ability to use more than one PLMN ID (i.e. with same or different country code (MCC) some of which is specified in TS 23.122 [17] and different network codes (MNC)) or combinations of PLMN ID and NID. 5G MOCN supports NG-RAN Sharing with or without multiple Cell Identity broadcast as described in TS 38.300 [27].

5G MOCN also supports the following sharing scenarios involving non-public networks:

- NG-RAN is shared by multiple SNPNs (each identified by PLMN ID and NID);

- NG-RAN is shared by one or multiple SNPNs and one or multiple PLMNs;

- NG-RAN is shared by one or more PNI-NPNs (with CAG) and one or more SNPNs; and

- NG-RAN is shared by one or multiple PLMNs and one or multiple PNI-NPNs (with CAG).

NOTE 1: PNI-NPNs (without CAG) are not explicitly listed above as it does not require additional NG-RAN sharing functionality compared to sharing by one or multiple PLMNs.

In all non-public network sharing scenarios, each Cell Identity is associated with one of the following configuration options:

- one or multiple SNPNs;

- one or multiple PNI-NPNs (with CAG); or

- one or multiple PLMNs only.

NOTE 2: Different PLMN IDs (or combinations of PLMN ID and NID) can also point to the same 5GC. When same 5GC supports multiple SNPNs (identified by PLMN ID and NID), then they are not used as equivalent SNPNs for a UE.

NOTE 3: There is no standardized mechanism to avoid paging collisions if the same 5G-S-TMSI is allocated to different UEs by different PLMNs or SNPNs of the shared network, as the risk of paging collision is assumed to be very low. If such risk is to be eliminated then PLMNs and SNPNs of the shared network needs to coordinate the value space of the 5G-S-TMSI to differentiate the PLMNs and SNPNs of the shared network.



Figure 5.18.1-1: A 5G Multi-Operator Core Network (5G MOCN) in which multiple CNs are
connected to the same NG-RAN

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## 5.30 Support for non-public networks

### 5.30.1 General

A Non-Public Network (NPN) is a 5GS deployed for non-public use, see TS 22.261 [2]. An NPN is either:

- a Stand-alone Non-Public Network (SNPN), i.e. operated by an NPN operator and not relying on network functions provided by a PLMN, or

- a Public Network Integrated NPN (PNI-NPN), i.e. a non-public network deployed with the support of a PLMN.

NOTE: An SNPN and a PLMN can share NG-RAN as described in clause 5.18.

SNPN 5GS deployments are based on the architecture depicted in clause 4.2.3, the architecture for 5GC with untrusted non-3GPP access (Figure 4.2.8.2.1-1) for access to SNPN services via a PLMN (and vice versa) and the additional functionality covered in clause 5.30.2.

Interworking with EPS is not supported for SNPN.

Public Network Integrated NPNs are described in clause 5.30.3.

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#### 5.30.2.4 Network selection in SNPN access mode

When a UE is set to operate in SNPN access mode the UE does not perform normal PLMN selection procedures as defined in clause 4.4 of TS 23.122 [17].

UEs operating in SNPN access mode read the available PLMN IDs and list of available NIDs from the broadcast system information and take them into account during network selection.

For automatic network selection, the UE selects and attempts to register with the available SNPN identified by a PLMN ID and NID for which the UE has SUPI and credentials. If multiple SNPNs are available that the UE has respective SUPI and credentials for, then the priority order for selecting and attempting to register with SNPNs is based on UE implementation.

For manual network selection UEs operating in SNPN access mode provide to the user the list of SNPN IDs and related human-readable names (if available) of the available SNPNs the UE has respective SUPI and credentials for.

NOTE1: The details of SNPN selection is defined in TS 23.122 [17].

NOTE2: The SNPN doesn’t support roaming in this release.

When a UE performs Initial Registration to an SNPN, the UE shall indicate the selected NID and the corresponding PLMN ID to NG-RAN. NG-RAN shall inform the AMF of the selected PLMN ID and NID.

#### 5.30.2.5 Network access control

If a UE performs the registration or service request procedure in an SNPN identified by a PLMN ID and a self-assigned NID and there is no subscription for the UE, then the AMF shall reject the UE with an appropriate cause code to temporarily prevent the UE from automatically selecting and registering with the same SNPN.

If a UE performs the registration or service request procedure in an SNPN identified by a PLMN ID and a coordinated assigned NID and there is no subscription for the UE, then the AMF shall reject the UE with an appropriate cause code to permanently prevent the UE from automatically selecting and registering with the same SNPN.

NOTE: The details of rejection and cause codes is defined in TS 24.501 [47].

In order to prevent access to SNPNs for authorized UE(s) in case of network congestion/overload, Unified Access Control information is configured per SNPN (i.e. as part of the subscription information that the UE has for a given SNPN) and provided to the UE as described in TS 24.501 [47].

#### 5.30.2.6 Cell (re-)selection in SNPN access mode

UEs operating in SNPN access mode only select cells and networks broadcasting both PLMN ID and NID of the selected SNPN.

NOTE: Further details on the NR idle and inactive mode procedures for SNPN cell selection is defined in TS 38.331 [28] and in TS 38.304 [50].

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### 5.30.3 Public Network Integrated NPN

#### 5.30.3.1 General

Public Network Integrated NPNs are NPNs made available via PLMNs e.g. by means of dedicated DNNs, or by one (or more) Network Slice instances allocated for the NPN. The existing network slicing functionalities apply as described in clause 5.15. When a PNI-NPN is made available via a PLMN, then the UE shall have a subscription for the PLMN in order to access PNI-NPN.

NOTE 1: Annex D provides additional consideration to consider when supporting Non-Public Network as a Network Slice of a PLMN.

As network slicing does not enable the possibility to prevent UEs from trying to access the network in areas where the UE is not allowed to use the Network Slice allocated for the NPN, Closed Access Groups may optionally be used to apply access control.

A Closed Access Group identifies a group of subscribers who are permitted to access one or more CAG cells associated to the CAG.

CAG is used for the PNI-NPNs to prevent UE(s), which are not allowed to access the NPN via the associated cell(s), from automatically selecting and accessing the associated CAG cell(s).

NOTE 2: CAG is used for access control e.g. authorization at cell selection and configured in the subscription as part of the Mobility Restrictions i.e. independent from any S-NSSAI. CAG is not used as input to AMF selection nor Network Slice selection. If NPN isolation is desired, operator can better support NPN isolation by deploying network slicing for PNI-NPN, configuring dedicated S-NSSAI(s) for the given NPN as specified in Annex D, clause D.2 and restricting NPN's UE subscriptions to these dedicated S-NSSAI(s).

The following clauses describes the functionality needed for supporting CAGs.

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#### 5.30.3.3 UE configuration, subscription aspects and storage

To use CAG, the UE may be pre-configured or (re)configured with the following CAG information, included in the subscription as part of the Mobility Restrictions:

- an Allowed CAG list i.e. a list of CAG Identifiers the UE is allowed to access; and

- optionally, a CAG-only indication whether the UE is only allowed to access 5GS via CAG cells (see TS 38.304 [50] for how the UE identifies whether a cell is a CAG cell);

The HPLMN may configure or re-configure a UE with the above CAG information using the UE Configuration Update procedure for access and mobility management related parameters described in TS 23.502 [3] in clause 4.2.4.2.,

The above CAG information is provided by the HPLMN on a per PLMN basis. In a PLMN the UE shall only consider the CAG information provided for this PLMN.

The UE shall store the latest available CAG information for every PLMN for which it is provided and keep it stored when the UE is de-registered.

NOTE: CAG information has no implication on whether and how the UE accesses 5GS over non-3GPP access.

#### 5.30.3.4 Network and cell (re-)selection, and access control

The following is assumed for network and cell selection, and access control:

- The CAG cell shall broadcast information such that only UEs supporting CAG are accessing the cell (see TS 38.300 [27], TS 38.304 [50]);

NOTE 1: The above also implies that cells are either CAG cells or normal PLMN cells.

- In order to prevent access to NPNs for authorized UE(s) in case of network congestion/overload, existing mechanisms defined for Control Plane load control, congestion and overload control in clause 5.19 can be used, as well as the access control and barring functionality described in clause 5.2.5, or Unified Access Control using the access categories as defined in TS 24.501 [47] can be used.

- For aspects of automatic and manual network selection in relation to CAG, see TS 23.122 [17];

- For aspects related to cell (re-)selection, see TS 38.304 [50];

- The Mobility Restrictions shall be able to restrict the UE's mobility according to the Allowed CAG list (if configured in the subscription) and include an indication whether the UE is only allowed to access CAG cells (if configured in the subscription);

- During transition from CM-IDLE to CM-CONNECTED, if the UE is accessing the 5GS via a CAG cell, the UE shall provide the selected CAG Identifier to NG-RAN and the NG-RAN shall provide the CAG Identifier to the AMF:

- The AMF shall verify whether UE access is allowed by Mobility Restrictions:

- If the CAG Identifier received from the NG-RAN is part of the UE's Allowed CAG list, then the AMF accepts the NAS request;

- If the CAG Identifier received from the NG-RAN is not part of the UE's Allowed CAG list, then the AMF rejects the NAS request with an appropriate cause code, whereas the UE removes that CAG Identifier, if it exists, from its Allowed CAG list, as defined in TS 24.501 [47]. The AMF shall then release the NAS signalling connection for the UE by triggering the AN release procedure; and

- If the UE is accessing the network via a non-CAG cell and the UE's subscription contains an indication that the UE is only allowed to access CAG cells, then the AMF rejects the NAS request with an appropriate cause code, whereas the UE updates its local configuration, as defined in TS 24.501 [47]. The AMF shall then release the NAS signalling connection for the UE by triggering the AN release procedure.

- During transition from RRC Inactive to RRC Connected state:

- When the UE initiates the RRC Resume procedure for RRC Inactive to RRC Connected state transition in a CAG cell, NG-RAN shall reject the RRC Resume request from the UE if none of the CAG Identifiers supported by the CAG cell are part of the UE's Allowed CAG list according to the Mobility Restrictions received from the AMF.

- When the UE initiates the RRC Resume procedure for RRC Inactive to RRC Connected state transition in a non-CAG cell, NG-RAN shall reject the UE's Resume request if the UE is only allowed to access CAG cells according to the Mobility Restrictions received from the AMF.

- During connected mode mobility procedures:

- Based on the Mobility Restrictions received from the AMF:

- Source NG-RAN shall not handover the UE to a target NG-RAN node if the target is a CAG cell and none of the CAG Identifiers supported by the CAG cell are part of the UE's Allowed CAG list;

- Source NG-RAN shall not handover the UE to a non-CAG cell if the UE is only allowed to access CAG cells;

- Update of Mobility Restrictions:

- When the AMF receives the Nudm\_SDM\_Notification from the UDM and the AMF determines that the Allowed CAG list or the indication whether the UE is only allowed to access CAG cells have changed;

- The AMF shall update the Mobility Restrictions in the UE and NG-RAN accordingly; and

- Upon receiving Mobility Restrictions from AMF, NG-RAN determines if the UE is currently accessing a CAG cell and the CAG Identifier(s) supported by the CAG cell have been removed from the Allowed CAG list or if the UE is currently accessing a non-CAG cell and the indication that the UE is only allowed to access CAG cells has been set in the subscription, then the NG-RAN shall initiate actions for the UE (e.g. a handover or AN release) to ensure that the UE is no longer served by the current cell.

NOTE 2: When the UE is accessing the network for emergency service the conditions for AMF in clause 5.16.4.3 apply.

\*\*\* END CHANGES \*\*\*