**3GPP TSG-CT WG1 Meeting #134-eC1-22xxxx**

**E-meeting, 17th – 25th February 2022 (was C1-221270)**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **23.122** | **CR** | **0885** | **rev** | **1** | **Current version:** | **17.5.0** |  |
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| *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 |  | Core Network | **X** |

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| ***Title:***  | Enabling update of list of preferred PLMNs in an SNPN |
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| ***Source to WG:*** | Qualcomm Incorporated, InterDigital |
| ***Source to TSG:*** | C1 |
|  |  |
| ***Work item code:*** | eNPN |  | ***Date:*** | 2022-02-21 |
|  |  |  |  |  |
| ***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)* |
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| ***Reason for change:*** | At CT1#133bis-e, it was agreed in CR 0858 to TS 23.122 (C1-220605) to enable the use of the SOR procedure to update the SOR-SNPN-SI when the UE is registered to a PLMN.It is proposed to enable the reverse scenario, i.e. update of the list of preferred PLMN/access technology combinations when the UE is registered to an SNPN. The use of this procedure is optional for the HPLMN. |
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| ***Summary of change:*** | * the use of the SOR procedure to update the list of preferred PLMN/access technology combinations when the UE is registered to an SNPN was enabled for the case when the HPLMN supports sending the list of preferred PLMN/access technology combinations in plain text or secured packet to the UE when the UE is registered to an SNPN
* receipt of the list of preferred PLMN/access technology combinations in an SNPN does NOT trigger PLMN selection at the UE
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| ***Consequences if not approved:*** | If the credentials holder is a PLMN and the list of preferred PLMN/access technology combinations for the UE changes while the UE is registered to an SNPN, the credentials holder will have to wait until the UE registers to a PLMN to update the list of preferred PLMN/access technology combinations at the UE, resulting in the UE initially selecting a PLMN that might not be the most preferred one or that might be a PLMN which the UE is no longer allowed to access. |
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| ***Clauses affected:*** | C.1.2, C.X (New) |
|  |  |
|  | **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:*** |  |

\*\*\* First change \*\*\*

### C.1.2 Steering of roaming over the control plane in an SNPN

The purpose of the control plane solution for steering of roaming in 5GS procedure in an SNPN is to allow the HPLMN or subscribed SNPN to update one or more of the following via NAS signalling:

a) the SOR-SNPN-SI associated with the selected entry of "list of subscriber data" or the selected PLMN subscription in the ME, for a UE which supports access to an SNPN using credentials from a credential holder; and

b) the SOR-CMCI.

The control plane solution for steering of roaming in 5GS procedure in an SNPN can also be used by the HPLMN to update the "Operator Controlled PLMN Selector with Access Technology" list in the UE by providing the HPLMN protected list of preferred PLMN/access technology combinations or a secured packet.

The HPLMN or subscribed SNPN can provide the steering of roaming information to the UE using the control plane mechanism during and after registration. The HPLMN or subscribed SNPN updates the SOR-SNPN-SI based on the HPLMN or subscribed SNPN policies, which can be based on the registered SNPN, the location of the UE, etc.

If the UE supports access to an SNPN using credentials from a credentials holder, the UE shall indicate ME’s support for SOR-SNPN-SI when registering in a subscribed SNPN or in the HPLMN.

Editor’s note (WI eNPN, CR#0790): How the UE signals ME’s support for SOR-SNPN-SI when registering in a subscribed SNPN or in the HPLMN needs to be specified in TS 24.501.

The HPLMN or subscribed SNPN can configure their subscribed UEs’ SNPN configuration parameters associated with the PLMN subscription or the selected entry of the “list of subscriber data”, respectively, to expect to receive the steering of roaming information due to initial registration in a non-subscribed SNPN. At the same time the HPLMN or subscribed SNPN will mark the UE as expecting to receive the steering of roaming information due to initial registration in a non-subscribed SNPN, in the subscription information in the UDM. In this case, it is mandatory for the HPLMN or subscribed SNPN to provide the steering of roaming information to the UE during initial registration in a non-subscribed SNPN. Otherwise if such configuration is not provided in the ME, it is optional for the HPLMN or subscribed SNPN to provide the steering of roaming information to the UE during initial registration (based on HPLMN or subscribed SNPN policy). The HPLMN or subscribed SNPN can provide the steering of roaming information to the UE during the registration procedure for mobility registration update and initial registration procedure for emergency services. In addition, the HPLMN or subscribed SNPN can request the UE to provide an acknowledgement of successful reception of the steering of roaming information.

NOTE 1: In annex C of this specification, the User Data Repository (UDR) is considered as part of the UDM.

As the HPLMN or subscribed SNPN needs to consider certain criteria including the number of customers distributed through multiple SNPNs in the same country or region, the SOR-SNPN-SI is not necessarily the same at all times and for all users.

NOTE 2: The functional description of this dedicated application function (SOR-AF) is out of scope of 3GPP.

The steering of roaming connected mode control information (SOR-CMCI) enables the HPLMN or subscribed SNPN to control the timing of a UE in connected mode to move to idle mode, if the UE decides to perform SNPN selection upon receiving the steering of roaming information. The UE shall support the SOR-CMCI. The support and use of SOR-CMCI by the HPLMN or subscribed SNPN is based on the HPLMN or subscribed SNPN policy.

The following requirements are applicable for the SOR-CMCI:

- The HPLMN or subscribed SNPN may configure SOR-CMCI in the UE and may also send SOR-CMCI over N1 NAS signalling. The SOR-CMCI received over N1 NAS signalling has precedence over the SOR-CMCI configured in the UE.

- The UE shall indicate ME’s support for SOR-CMCI to the HPLMN or subscribed SNPN.

NOTE 3: If the credentials holder is the HPLMN, the HPLMN has the knowledge of the USIM’s capabilities in supporting SOR-CMCI.

- While performing SOR, the UE shall consider the SOR-SNPN-SI received in the SOR information together with the available SOR-CMCI.

- The HPLMN or subscribed SNPN may provision the SOR-CMCI in the UE over N1 NAS signalling. The UE shall store the configured SOR-CMCI in the non-volatile memory of the ME or in the USIM as described in clause C.4.

In order to support various deployment scenarios, the UDM may support:

- obtaining the SOR-SNPN-SI which is or becomes available in the UDM (i.e. retrieved from the UDR);

- obtaining the SOR-SNPN-SI from the SOR-AF; or

- both of the above.

The HPLMN or subscribed SNPN policy for the SOR-AF invocation can be present in the UDM only if the UDM supports obtaining the SOR-SNPN-SI from the SOR-AF.

The UDM discards any SOR-SNPN-SI obtained from the SOR-AF or which is or becomes available in the UDM (i.e. retrieved from the UDR), either during registration (as specified in annex C.5) or after registration (as specified in annex C.6), when the UDM cannot successfully forward the SOR information to the AMF (e.g. in case the UDM receives the response from the SOR-AF with the SOR-SNPN-SI after the expiration of the HPLMN or subscribed SNPN specific timer, or if there is no AMF registered for the UE).

The UE maintains a list of “SNPNs where registration was aborted due to SOR” per entry of the “list of subscriber data” or the PLMN subscription. If the UE receives steering of roaming information in the REGISTRATION ACCEPT or DL NAS TRANSPORT message in an SNPN and the security check to verify that the steering of roaming information is provided by the HPLMN or subscribed SNPN is successful, the UE shall remove the current selected SNPN from the list of “SNPNs where registration was aborted due to SOR” for the selected entry of the “list of subscriber data” or the selected PLMN subscription. The UE shall delete the list of “SNPNs where registration was aborted due to SOR” when the selected entry of the “list of subscriber data” is updated or the UICC containind the USIM is removed.

If:

- the UE’s ME is configured to indicate that the UE shall expect to receive the steering of roaming information during initial registration procedure for the selected entry of the “list of subscriber data” or the selected PLMN subscription but did not receive it or security check on the steering of roaming information fails;

- the current chosen non-subscribed SNPN is not contained in the list of “SNPNs where registration was aborted due to SOR” for the selected entry of the “list of subscriber data” or the selected PLMN subscription;

- the current chosen non-subscribed SNPN is not part of the user controlled prioritized list of preferred SNPNs for the selected entry of the “list of subscriber data” or the selected PLMN subscription; and

- the UE is not in manual mode of operation;

then the UE will perform SNPN selection with the current SNPN considered as lowest priority.

It is mandatory for the non-subscribed SNPN to transparently forward to the UE the steering of roaming information received from the HPLMN or subscribed SNPN and to transparently forward to the HPLMN or subscribed SNPN the acknowledgement of successful reception of the steering of roaming information received from the UE, both while the UE is trying to register onto the non-subscribed SNPN as described in clause C.5, and after the UE has registered onto the non-subscribed SNPN as described in clause C.6.

The ME shall delete the SOR-SNPN-SI stored in the ME when the selected entry of the “list of subscriber data” is updated or the UICC containind the USIM is removed.

Editor’s note (WI eNPN, CR#0790): It is FFS whether update of any parameters (or just a subset of the parameters) in the the selected entry of the “list of subscriber data” triggers removal of the SOR-SNPN-SI.

The procedure in this annex for steering of UE in an SNPN can be initiated by the network while the UE is trying to register onto a non-subscribed SNPN as described in clause C.5, or after the UE has registered onto the subscribed SNPN or a non-subscribed SNPN as described in clause C.6 and C.X.

\*\*\* Next change \*\*\*

## C.X Stage-2 flow for providing UE with list of preferred PLMN/access technology combinations in SNPN after registration

The stage-2 flow for providing UE with the list of preferred PLMN/access technology combinations in an SNPN after registration is indicated in figure C.X.1. The selected SNPN is a non-subscribed SNPN. The AMF is located in the selected SNPN. The UDM is located in the HPLMN.

In this procedure, the list of preferred PLMN/access technology combinations is sent in plain text or sent within the secured packet, without the SOR-SNPN-SI.

Based on HPLMN policy, if the HPLMN supports sending the list of preferred PLMN/access technology combinations in plain text or secured packet to the UE when the UE is registered to an SNPN, then the procedure is triggered:

- If the UDM supports obtaining a list of preferred PLMN/access technology combinations or a secured packet from the SOR-AF, the HPLMN policy for the SOR-AF invocation is present in the UDM and the SOR-AF provides the UDM with a new list of preferred PLMN/access technology combinations or a secured packet for a UE identified by SUPI; or

- When a new list of preferred PLMN/access technology combinations or a secured packet becomes available in the UDM (i.e., retrieved from the UDR).

Figure C.X.1: Procedure for configuring UE with list of preferred PLMN/access technology combinations in an SNPN after registration

For the steps below, security protection is described in 3GPP TS 33.501 [24].

1) The SOR-AF to the UDM: Nudm\_ParameterProvision\_Update request is sent to the UDM to trigger the update of the UE with the new list of preferred PLMN/access technology combinations or a secured packet for a UE identified by SUPI.

2) The UDM to the AMF: The UDM notifies the changes of the user profile to the affected AMF by the means of invoking Nudm\_SDM\_Notification service operation. The Nudm\_SDM\_Notification service operation contains the steering of roaming information that needs to be delivered transparently to the UE over NAS within the Access and Mobility Subscription data. If the HPLMN or subscribed SNPN decided that the UE is to acknowledge successful security check of the received steering of roaming information, the Nudm\_SDM\_Notification service operation also contains an indication that the UDM requests an acknowledgement from the UE as part of the steering of roaming information.

3) The AMF to the UE: the AMF sends a DL NAS TRANSPORT message to the served UE. The AMF includes in the DL NAS TRANSPORT message the steering of roaming information received from the UDM.

4) Upon receiving the steering of roaming information, the UE shall perform a security check on the steering of roaming information included in the DL NAS TRANSPORT message to verify that the steering of roaming information is provided by HPLMN, and:

a) if the security check is successful:

- if the steering of roaming information contains a secured packet (see 3GPP TS 31.115 [67]) and the service "data download via SMS Point-to-point" is allocated and activated in the USIM Service Table (see 3GPP TS 31.102 [40]), the ME shall upload the secured packet to the USIM using procedures in 3GPP TS 31.111 [41]; and

- if the steering of roaming information contains the list of preferred PLMN/access technology combinations, the ME shall replace the highest priority entries in the "Operator Controlled PLMN Selector with Access Technology" list stored in the ME with the received list of preferred PLMN/access technology combinations, and delete the PLMNs identified by the list of preferred PLMN/access technology combinations from the Forbidden PLMN list and from the Forbidden PLMNs for GPRS service list, if they are present in these lists.

 If the UDM has requested an acknowledgement from the UE in the DL NAS TRANSPORT message, the UE sends an UL NAS TRANSPORT message to the serving AMF with an SOR transparent container including the UE acknowledgement and the UE shall set the "ME support of SOR-SNPN-SI" indicator to "supported".

 If the UDM has not requested an acknowledgement from the UE then step 5 is skipped; and

b) if the security check is not successful and the UE is in automatic network selection mode, then:

- if the UE has a SOR-CMCI stored in the non-volatile memory of the ME, the current SNPN is considered as lowest priority and the UE shall apply the actions in clause C.4.2;

- otherwise, the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority SNPN as specified in clause 4.9.3, with an exception that the current SNPN is considered as lowest priority. If the UE has an established emergency PDU session then the UE shall attempt to perform the SNPN selection after the emergency PDU session is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

 Step 5 is skipped;

NOTE 1: When the UE is in the manual mode of operation or the current chosen non-subscribed SNPN is part of the user controlled prioritized list of preferred SNPNs, the UE stays on current chosen non-subscribed SNPN.

5) The AMF to the UDM: If the UL NAS TRANSPORT message with an SOR transparent container is received, the AMF uses the Nudm\_SDM\_Info service operation to provide the received SOR transparent container to the UDM. If the HPLMN decided that the UE is to acknowledge successful security check of the received steering of roaming information in step 2, the UDM verifies that the acknowledgement is provided by the UE. The UDM shall store the "ME support of SOR-SNPN-SI" indicator.

 If the present flow was invoked by the UDM after receiving from the SOR-AF a list of preferred PLMN/access technology combinations or a secured packetI for a UE identified by SUPI using an Nudm\_ParameterProvision\_Update request, and the UDM verification of the UE acknowledgement is successful, then the UDM informs the SOR-AF about successful delivery of the steering of roaming information using Nsoraf\_SoR\_Info (SUPI of the UE, successful delivery); and

6) The UDM to the SOR-AF: Nsoraf\_SoR\_Info (SUPI of the UE, successful delivery, "ME support of SOR-SNPN-SI" indicator). If the HPLMN policy for the SOR-AF invocation is present and the HPLMN UDM received and verified the UE acknowledgement in step 5, then the UDM informs the SOR-AF about successful delivery of the steering of roaming information to the UE. The UDM shall include the "ME support of SOR-SNPN-SI" indicator.

If:

- the UE in manual mode of operation encounters security check failure of SOR information in DL NAS TRANSPORT message; and

- upon switching to automatic network selection mode the UE remembers that it is still registered on non-subscribed SNPN where the security check failure of SOR information was encountered;

the UE shall wait until it moves to idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]) before attempting to obtain service on a higher priority SNPN as specified in clause 4.9.3, with an exception that the current registered SNPN is considered as lowest priority. If the UE has an established emergency PDU session then the UE shall attempt to perform the SNPN selection after the emergency PDU session is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

NOTE 2: The receipt of the steering of roaming information by itself does not trigger the release of the emergency PDU session.

\*\*\* End of changes \*\*\*