**3GPP TSG-CT WG1 Meeting #137-e *Rev\_*C1-224774**

**E-Meeting, 18th – 26th August 2022**

|  |
| --- |
| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **24.501** | **CR** | **4519** | **rev** | **1** | **Current version:** | **17.7.1** |  |
|  |
| *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)*.* |
|  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

|  |
| --- |
|  |
| ***Title:***  | Registering slices removed from rejected NSSAI list |
|  |  |
| ***Source to WG:*** | Apple |
| ***Source to TSG:*** | C1 |
|  |  |
| ***Work item code:*** | 5GProtoc18 |  | ***Date:*** | 2022-08-10 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-18 |
|  | *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:*** | The network may reject the use of a slice for a UE using NR and connected to 5GC and return cause code. #62 (No network slices available). The UE may then disable N1 mode, or the TAI may be added to forbidden TAI list. The UE may then register with LTE and thereafter, the previously rejected slice may become available and the UE may be notified from the network in ePCO causing the slice to be removed from the rejected NSSAI list. The UE can now use this slice with NR in 5GC. However, to do so the UE may need to re-enable N1 mode or remove the previously added TAI from the forbidden TAI list. Consider the following use cases:Use case 1:1] UE is registered on NR RAT in 5GC in PLMN-1 with S-NSSAI-1 as one of the registered slices.2] Subsequently, UE receives cause #62 with S-NSSAI-1 part of rejected NSSAI with cause “S-NSSAI not available in the current PLMN or SNPN”3] UE disables N1 mode & registers on LTE in EPS4] UE receives S-NSSAI-1 associated with PLMN-1 during the PDN connection establishment procedure in EPS & removes S-NSSAI\_1 from the rejected NSSAI list & adds it in configured NSSAI list for PLMN-15] However, UE is unable to register to S-NSSAI-1 until N1 mode is re-enabled via other triggers.Use case 2:1] UE is registered in PLMN-1, TAI-1 on NR RAT with S-NSSAI-1 as one of the registered slices.2] Subsequently, UE receives cause #62 with S-NSSAI-1 part of rejected NSSAI with cause “S-NSSAI not available in the current registration area”3] UE adds TAI-1 to forbidden TAI list & registers on LTE in EPS4] UE receives S-NSSAI-1 associated with PLMN-1 during the PDN connection establishment procedure in EPS & removes S-NSSAI-1 from rejected NSSAI list & adds it in configured NSSAI list for PLMN-15] UE is unable to register to S-NSSAI-1 using NR in 5GC until TAI-1 is removed from forbidden TAI list via other triggers. |
|  |  |
| ***Summary of change:*** | In case 1, UE should re-enable N1 mode and in case 2 UE should remove TAI-1 from forbidden TAI list. |
|  |  |
| ***Consequences if not approved:*** | UE will not be able to register to the slices which may no longer be considered as rejected by the network resulting in bad user experience. |
|  |  |
| ***Clauses affected:*** | 4.6.2.2, 4.9.2, 5.3.13 |
|  |  |
|  | **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 \*\*\*\*\*

#### 4.6.2.2 NSSAI storage

If available, the configured NSSAI(s) shall be stored in a non-volatile memory in the ME as specified in annex C. For a configured NSSAI, if there is associated NSSRG information, the NSSRG information shall also be stored in a non-volatile memory in the ME as specified in annex C. For a configured NSSAI, if there is associated NSAG information, the NSAG information shall be stored in the ME. The support for NSSRG information and NSAG information by a UE or an AMF is optional.

The allowed NSSAI(s) should be stored in a non-volatile memory in the ME as specified in annex C.

Each of the configured NSSAI stored in the UE is a set composed of at most 16 S-NSSAIs. Each of the allowed NSSAI stored in the UE is a set composed of at most 8 S-NSSAIs and is associated with a PLMN identity or SNPN identity, an access type and, if the UE supports access to an SNPN using credentials from a credentials holder, the selected entry of the “list of subscriber data” or the selected PLMN subscription. Each of the configured NSSAI except the default configured NSSAI, and the rejected NSSAI is associated with a PLMN identity or SNPN identity and, if the UE supports access to an SNPN using credentials from a credentials holder, the selected entry of the “list of subscriber data” or the selected PLMN subscription. Each of the pending NSSAI stored in the UE is a set composed of at most 16 S-NSSAIs and is associated with a PLMN identity or SNPN identity and, if the UE supports access to an SNPN using credentials from a credentials holder, the selected entry of the “list of subscriber data” or the selected PLMN subscription. The S-NSSAI(s) in the rejected NSSAI for the current registration area are further associated with one or more tracking areas where the rejected S-NSSAI(s) is not available. The S-NSSAI(s) in the rejected NSSAI for the current PLMN or SNPN shall be considered rejected for the current PLMN or SNPN regardless of the access type. The S-NSSAI(s) in the rejected NSSAI for the failed or revoked NSSAA shall be considered rejected for the current PLMN or SNPN regardless of the access type. The S-NSSAI(s) in the rejected NSSAI for the maximum number of Ues reached are further associated with the access type over which the rejected NSSAI was received. There shall be no duplicated PLMN identities or SNPN identities associated with each of the list of configured NSSAI(s), pending NSSAI(s), rejected NSSAI(s) for the current PLMN or SNPN, rejected NSSAI(s) for the current registration area, rejected NSSAI(s) for the failed or revoked NSSAA, and rejected NSSAI for the maximum number of Ues reached.

The UE stores NSSAIs as follows:

a) The configured NSSAI shall be stored until a new configured NSSAI is received for a given PLMN or SNPN. The network may provide to the UE the mapped S-NSSAI(s) for the new configured NSSAI which shall also be stored in the UE. When the UE is provisioned with a new configured NSSAI for a PLMN or SNPN, the UE shall:

1) replace any stored configured NSSAI for this PLMN or SNPN with the new configured NSSAI for this PLMN or SNPN;

2) delete any stored mapped S-NSSAI(s) for the configured NSSAI and, if available, store the mapped S-NSSAI(s) for the new configured NSSAI;

3) delete any stored allowed NSSAI for this PLMN or SNPN and, if available, the stored mapped S-NSSAI(s) for the allowed NSSAI, if the UE received the new configured NSSAI for this PLMN or SNPN and the Configuration update indication IE with the Registration requested bit set to “registration requested”, in the same CONFIGURATION UPDATE COMMAND message but without any new allowed NSSAI for this PLMN or SNPN included;

4) delete any stored rejected NSSAI, and stop the timer T3526 associated with the deleted rejected S-NSSAI for the maximum number of Ues reached if running;

4A) remove from the stored mapped S-NSSAI(s) for the rejected NSSAI for the current PLMN or SNPN and the stored mapped S-NSSAI(s) for the rejected NSSAI for the current registration area and the stored rejected NSSAI for the maximum number of Ues reached, the S-NSSAI(s), if any, included in the mapped S-NSSAI(s) for the new configured NSSAI for the current PLMN or SNPN (if the UE is roaming), and stop the timer T3526 associated with the deleted rejected S-NSSAI for the maximum number of Ues reached if running; and

5) delete any S-NSSAI(s) stored in the pending NSSAI that are not included in the new configured NSSAI for the current PLMN or SNPN or any mapped S-NSSAI(s), if any, stored in the pending NSSAI that are not included in the mapped S-NSSAI(s) for the configured NSSAI (if the UE is roaming);

 If the UE receives an S-NSSAI associated with a PLMN ID from the network during the PDN connection establishment procedure in EPS as specified in 3GPP TS 24.301 [15] or via ePDG as specified in 3GPP TS 24.302 [16], the UE may store the received S-NSSAI in the configured NSSAI for the PLMN identified by the PLMN ID associated with the S-NSSAI, if not already included in the configured NSSAI;

 The UE may continue storing a received configured NSSAI for a PLMN and associated mapped S-NSSAI(s), if available, when the UE registers in another PLMN.

NOTE 1: The maximum number of configured NSSAIs and associated mapped S-NSSAIs for PLMNs other than the HPLMN that need to be stored in the UE, and how to handle the stored entries, are up to UE implementation.

Ab) The NSAG information shall be stored until:

1) a new NSAG information is received for the registered PLMN over 3GPP access; or

2) a new configured NSSAI without any associated NSAG information is received for the registered PLMN over 3GPP access.

 When a new NSAG information for the registered PLMN over 3GPP access is received, the UE shall replace any stored NSAG information for the registered PLMN and its equivalent PLMN(s) with the new NSAG information for the registered PLMN.

 When a new configured NSSAI without any associated NSAG information is received for the registered PLMN over 3GPP access, the UE shall delete any stored NSAG information for the registered PLMN and its equivalent PLMN(s).

NOTE 2: Whether the UE stores the NSAG information also when the UE is switched off or when the UE is deregistered from the registered PLMN over 3GPP access is implementation specific.

b) The allowed NSSAI shall be stored until:

1) a new allowed NSSAI for the same access type (i.e. 3GPP access or non-3GPP access) is received for a given PLMN or SNPN;

2) the CONFIGURATION UPDATE COMMAND message with the Registration requested bit of the Configuration update indication IE set to “registration requested” is received and contains no other parameters (see subclauses 5.4.4.2 and 5.4.4.3); or

3) the REGISTRATION ACCEPT message is received with the “NSSAA to be performed” indicator of the 5GS registration result IE set to “Network slice-specific authentication and authorization is to be performed”, and the REGISTRATION ACCEPT message contains a pending NSSAI and no new allowed NSSAI as described in subclause 5.5.1.2.4 and subclause 5.5.1.3.4.

 The network may provide to the UE the mapped S-NSSAI(s) for the new allowed NSSAI (see subclauses 5.5.1.2 and 5.5.1.3) which shall also be stored in the UE. When a new allowed NSSAI for a PLMN or SNPN is received, the UE shall:

1) replace any stored allowed NSSAI for this PLMN or SNPN and its equivalent PLMN(s) for the same access type with the new allowed NSSAI for this PLMN or SNPN;

2) delete any stored mapped S-NSSAI(s) for the allowed NSSAI for this PLMN or SNPN and its equivalent PLMN(s) for the same access type and, if available, store the mapped S-NSSAI(s) for the new allowed NSSAI;

3) remove from the stored rejected NSSAI for the current PLMN or SNPN, the rejected NSSAI for the current registration area and rejected NSSAI for the maximum number of Ues reached, the S-NSSAI(s), if any, included in the new allowed NSSAI for the current PLMN or SNPN, unless the S-NSSAI in the rejected NSSAI is associated with one or more S-NSSAI(s) in the stored mapped rejected NSSAI and these mapped S-NSSAI(s) are not included in the mapped S-NSSAI(s) for the new allowed NSSAI, and stop the timer T3526 associated with the deleted rejected S-NSSAI for the maximum number of Ues reached if running;

4) remove from the stored rejected NSSAI for the failed or revoked NSSAA, the S-NSSAI(s), if any, included in the new allowed NSSAI for the current PLMN or SNPN (if the UE is not roaming) or the mapped S-NSSAI(s) for the new allowed NSSAI for the current PLMN or SNPN (if the UE is roaming);

5) remove from the stored mapped S-NSSAI(s) for the rejected NSSAI for the current PLMN or SNPN, the stored mapped S-NSSAI(s) for the rejected NSSAI for the current registration area and rejected NSSAI for the maximum number of Ues reached, the S-NSSAI(s), if any, included in the mapped S-NSSAI(s) for the new allowed NSSAI for the current PLMN or SNPN (if the UE is roaming), and stop the timer T3526 associated with the deleted rejected S-NSSAI for the maximum number of Ues reached if running; and

6) remove from the stored pending NSSAI for this PLMN or SNPN and its equivalent PLMN(s), one or more S-NSSAIs, if any, included in the new allowed NSSAI for the current PLMN or SNPN and its equivalent PLMN(s) (if the UE is not roaming) or the mapped S-NSSAI(s) for the new allowed NSSAI for the current PLMN or SNPN and its equivalent PLMN(s) (if the UE is roaming).

 If the UE receives the CONFIGURATION UPDATE COMMAND message with the Registration requested bit of the Configuration update indication IE set to “registration requested” and contains no other parameters (see subclauses 5.4.4.2 and 5.4.4.3), the UE shall delete any stored allowed NSSAI for this PLMN or SNPN, and delete any stored mapped S-NSSAI(s) for the allowed NSSAI, if available;

NOTE 3: Whether the UE stores the allowed NSSAI and the mapped S-NSSAI(s) for the allowed NSSAI also when the UE is switched off is implementation specific.

c) When the UE receives the S-NSSAI(s) included in the rejected NSSAI in the REGISTRATION ACCEPT message, the REGISTRATION REJECT message, the DEREGISTRATION REQUEST message or in the CONFIGURATION UPDATE COMMAND message, the UE shall:

1) store the S-NSSAI(s) into the rejected NSSAI and the mapped S-NSSAI(s) for the rejected NSSAI based on the associated rejection cause(s);

2) if the UE receives the S-NSSAI(s) included in the Rejected NSSAI IE, or if the UE receives the S-NSSAI(s) included in the Extended rejected NSSAI IE in non-roaming case, remove from the stored allowed NSSAI for the current PLMN or SNPN and its equivalent PLMN(s), the S-NSSAI(s), if any, included in the:

i) rejected NSSAI for the current PLMN or SNPN, for each and every access type;

ii) rejected NSSAI for the current registration area, associated with the same access type; or

iii) rejected NSSAI for the maximum number of Ues reached, associated with the same access type;

3) if the UE receives the S-NSSAI(s) included in the Extended rejected NSSAI IE in roaming case, remove from the stored allowed NSSAI for the current PLMN or SNPN and its equivalent PLMN(s), the S-NSSAI(s), if any, included in the:

i) rejected NSSAI for the current PLMN or SNPN, for each and every access type;

ii) rejected NSSAI for the current registration area, associated with the same access type; or

iii) rejected NSSAI for the maximum number of Ues reached, associated with the same access type;

 if the mapped S-NSSAI(s) for the S-NSSAI in the stored allowed NSSAI for the current PLMN or SNPN are stored in the UE, and the all of the mapped S-NSSAI are included in the Extended rejected NSSAI IE;

4) remove from the stored allowed NSSAI for the current PLMN or SNPN and its equivalent PLMN(s) (if the UE is not roaming) or the stored mapped S-NSSAI(s) for the allowed NSSAI (if available and if the UE is roaming), the S-NSSAI(s), if any, included in the:

i) rejected NSSAI for the failed or revoked NSSAA, for each and every access type;

ii) mapped S-NSSAI(s) for the rejected NSSAI for the current PLMN or SNPN, for each and every access type;

iii) mapped S-NSSAI(s) for the rejected NSSAI for the current registration area, associated with the same access type; or

iv) mapped S-NSSAI(s) for the rejected NSSAI for the maximum number of Ues reached, associated with the same access type;

5) if the UE receives the S-NSSAI(s) included in the Rejected NSSAI IE, or if the UE receives the S-NSSAI(s) included in the Extended rejected NSSAI IE in non-roaming case, remove from the stored pending NSSAI for the current PLMN or SNPN and its equivalent PLMN(s), the S-NSSAI(s), if any, included in the:

i) rejected NSSAI for the current PLMN or SNPN, for each and every access type;

ii) rejected NSSAI for the current registration area, associated with the same access type; or

iii) rejected NSSAI for the maximum number of Ues reached, associated with the same access type;

6) if the UE receives the S-NSSAI(s) included in the Extended rejected NSSAI IE in roaming case, remove from the stored pending NSSAI for the current PLMN or SNPN and its equivalent PLMN(s), the S-NSSAI(s), if any, included in the:

i) rejected NSSAI for the current PLMN or SNPN, for each and every access type;

ii) rejected NSSAI for the current registration area, associated with the same access type; or

iii) rejected NSSAI for the maximum number of Ues reached, associated with the same access type,

 if the mapped S-NSSAI(s) for the S-NSSAI in the stored pending NSSAI are stored in the UE, and all of the mapped S-NSSAI(s) are included in the Extended rejected NSSAI IE; and

7) remove from the stored pending NSSAI for the current PLMN and its equivalent PLMN(s) or SNPN (if the UE is not roaming) or the stored mapped S-NSSAI(s) for the pending NSSAI (if available and if the UE is roaming), the S-NSSAI(s) included in the:

i) rejected NSSAI for the failed or revoked NSSAA, for each and every access type;

ii) mapped S-NSSAI(s) for the rejected NSSAI for the current PLMN or SNPN, for each and every access type;

iii) mapped S-NSSAI(s) for the rejected NSSAI for the current registration area, associated with the same access type; or

iv) mapped S-NSSAI(s) for the rejected NSSAI for the maximum number of Ues reached, associated with the same access type;

8) If the UE receives the CONFIGURATION UPDATE COMMAND message with the Registration requested bit of the Configuration update indication IE set to “registration requested” and contains no other parameters (see subclauses 5.4.4.2 and 5.4.4.3), the UE shall delete any stored rejected NSSAI.

 When the UE:

1) enters state 5GMM-DEREGISTERED following an unsuccessful registration for 5GMM causes other than #62 “No network slices available” for the current PLMN or SNPN;

2) successfully registers with a new PLMN or SNPN;

3) enters state 5GMM-DEREGISTERED following an unsuccessful registration with a new PLMN; or

4) performs inter-system change from N1 mode to S1 mode and the UE successfully completes tracking area update procedure;

 and the UE is not registered with the current PLMN or SNPN over another access, the rejected NSSAI for the current PLMN or SNPN and the rejected NSSAI for the failed or revoked NSSAA shall be deleted.

 When the UE receive ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST message provided with S-NSSAI and the PLMN ID in the protocol configuration options IE or extended protocol configuration options IE (see subclause 6.2.2 of 3GPP TS 24.301 [15]), the UE shall remove the S-NSSAI associated with the PLMN ID from the rejected NSSAI for the current PLMN. When the UE receive ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST message provided with S-NSSAI and the PLMN ID in the protocol configuration options IE or extended protocol configuration options IE (see subclause 6.2.2 of 3GPP TS 24.301 [15]), the UE may remove the S-NSSAI from the rejected NSSAI for the maximum number of UEs reached for each and every access type, if any, and stop the timer T3526 associated with the S-NSSAI if running.

 When the UE:

1) deregisters over an access type;

2) successfully registers in a new registration area over an access type;

3) enters state 5GMM-DEREGISTERED or 5GMM-REGISTERED following an unsuccessful registration in a new registration area over an access type; or

4) performs inter-system change from N1 mode to S1 mode and the UE successfully completes tracking area update procedure;

 the rejected NSSAI for the current registration area corresponding to the access type shall be deleted;

d) When the UE receives the pending NSSAI in the REGISTRATION ACCEPT message, the UE shall replace any stored pending NSSAI for this PLMN or SNPN with the new pending NSSAI received in the REGISTRATION ACCEPT message for this PLMN or SNPN. If the UE does not receive the pending NSSAI in the REGISTRATION ACCEPT message and the "NSSAA to be performed" indicator is not set to "Network slice-specific authentication and authorization is to be performed" in the 5GS registration result IE of the REGISTRATION ACCEPT message, the UE shall delete the stored pending NSSAI, if any, for this PLMN or SNPN and its equivalent PLMN(s).

 If the registration area contains TAIs belonging to different PLMNs, which are equivalent PLMNs, then for each of the equivalent PLMNs, the UE shall replace any stored pending NSSAI with the pending NSSAI received in the registered PLMN.

 When the UE:

1) deregisters with the current PLMN or SNPN using explicit signalling or enters state 5GMM-DEREGISTERED for the current PLMN or SNPN;

2) successfully registers with a new PLMN or SNPN not in the list of equivalent PLMNs;

3) enters state 5GMM-DEREGISTERED following an unsuccessful registration with a new PLMN or SNPN; or

4) successfully initiates an attach or tracking area update procedure in S1 mode and the UE is operating in single-registration mode;

 and the UE is not registered with the current PLMN or SNPN over another access, the pending NSSAI for the current PLMN or SNPN and its equivalent PLMN(s) shall be deleted;

e) When the UE receives the Network slicing indication IE with the Network slicing subscription change indication set to "Network slicing subscription changed" in the REGISTRATION ACCEPT message or in the CONFIGURATION UPDATE COMMAND message, the UE shall delete the network slicing information for each of the PLMNs or SNPNs that the UE has slicing information stored for (excluding the current PLMN or SNPN). The UE shall delete any stored rejected NSSAI and stop the timer T3526 associated with the deleted rejected S-NSSAI for the maximum number of UEs reached if running. The UE shall not delete the default configured NSSAI. Additionally, the UE shall update the network slicing information for the current PLMN or SNPN (if received) as specified above in bullets a), b), c) and d); and

f) When the UE receives the new default configured NSSAI included in the default configured NSSAI update data in the Payload container IE of DL NAS TRANSPORT message, the UE shall replace any stored default configured NSSAI with the new default configured NSSAI. In case of SNPN, the UE shall replace the stored default configured NSSAI associated with the selected entry of the "list of subscriber data" or the PLMN subscription with the new default configured NSSAI.

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

### 4.9.2 Disabling and re-enabling of UE's N1 mode capability for 3GPP access

The UE shall only disable the N1 mode capability for 3GPP access when in 5GMM-IDLE mode.

When the UE is disabling the N1 mode capability for 3GPP access for a PLMN not due to redirection to EPC, it should proceed as follows:

a) select an E-UTRA cell connected to EPC of the registered PLMN or a PLMN from the list of equivalent PLMNs, if the UE supports S1 mode and the UE has not disabled its E-UTRA capability as specified in 3GPP TS 24.301 [15];

b) if an E-UTRA cell connected to EPC of the registered PLMN or a PLMN from the list of equivalent PLMNs cannot be found, the UE does not support S1 mode or the UE has disabled its E-UTRA capability as specified in 3GPP TS 24.301 [15], the UE may select another RAT of the registered PLMN or a PLMN from the list of equivalent PLMNs that the UE supports;

c) if another RAT of the registered PLMN or a PLMN from the list of equivalent PLMNs cannot be found, then enter the state 5GMM-REGISTERED.PLMN-SEARCH or 5GMM-DEREGISTERED.PLMN-SEARCH, or the UE does not have a registered PLMN, then enter the state 5GMM-DEREGISTERED.PLMN-SEARCH and perform PLMN selection as specified in 3GPP TS 23.122 [5]. If disabling of the N1 mode capability for 3GPP access was not due to a UE-initiated de-registration procedure for 5GS services over 3GPP access not due to switch-off, the UE may re-enable the N1 capability for this PLMN selection. As an implementation option, if the UE does not have a registered PLMN, instead of performing PLMN selection, the UE may select another RAT of the selected PLMN if the UE has chosen a PLMN and the RAT is supported by the UE; or

d) if no other allowed PLMN and RAT combinations are available, then the UE may re-enable the N1 mode capability for 3GPP access and indicate to lower layers to remain camped in NG-RAN of the registered PLMN, and may periodically scan for another PLMN and RAT combination which can provide EPS services or non-EPS services (if the UE supports EPS services or non-EPS services). How this periodic scanning is done, is UE implementation dependent.

When the UE is disabling the N1 mode capability for 3GPP access for an SNPN, it should proceed as follows:

a) enter the state 5GMM-REGISTERED.PLMN-SEARCH or 5GMM-DEREGISTERED.PLMN-SEARCH and perform SNPN selection as specified in 3GPP TS 23.122 [5]. If disabling of the N1 mode capability for 3GPP access was not due to a UE-initiated de-registration procedure for 5GS services over 3GPP access not due to switch-off, the UE may re-enable the N1 capability for this SNPN selection; or

b) if no other SNPN is available, then the UE may re-enable the N1 mode capability for 3GPP access and indicate to lower layers to remain camped in NG-RAN of the registered SNPN.

When the UE is disabling the N1 mode capability upon receiving cause value #31 "Redirection to EPC required" as specified in subclauses 5.5.1.2.5, 5.5.1.3.5 and 5.6.1.5, it should proceed as follows:

a) If the UE is in NB-N1 mode:

1) if lower layers do not provide an indication that the current E-UTRA cell is connected to EPC or lower layers do not provide an indication that the current E-UTRA cell supports CIoT EPS optimizations that are supported by the UE, search for a suitable NB-IoT cell connected to EPC according to 3GPP TS 36.304 [25C];

2) if lower layers provide an indication that the current E-UTRA cell is connected to EPC and the current E-UTRA cell supports CIoT EPS optimizations that are supported by the UE, perform a core network selection to select EPC as specified in subclause 4.8.4A.1; or

3) if lower layers cannot find a suitable NB-IoT cell connected to EPC or there is no suitable NB-IoT cell connected to EPC which supports CIoT EPS optimizations that are supported by the UE, the UE, as an implementation option, may indicate to lower layers to remain camped in E-UTRA cell connected to 5GCN, may then start an implementation-specific timer and enter the state 5GMM-REGISTERED.LIMITED-SERVICE. The UE may may re-enable the N1 mode capability for 3GPP access at expiry of the implementation-specific timer, if the timer had been started, and may then proceed with the appropriate 5GMM procedure.

b) If the UE is in WB-N1 mode:

1) if lower layers do not provide an indication that the current E-UTRA cell is connected to EPC or lower layers do not provide an indication that the current E-UTRA cell supports CIoT EPS optimizations that are supported by the UE, search for a suitable E-UTRA cell connected to EPC according to 3GPP TS 36.304 [25C];

2) if lower layers provide an indication that the current E-UTRA cell is connected to EPC and the current E-UTRA cell supports CIoT EPS optimizations that are supported by the UE, then perform a core network selection to select EPC as specified in subclause 4.8.4A.1; or

3) if lower layers cannot find a suitable E-UTRA cell connected to EPC or there is no suitable E-UTRA cell connected to EPC which supports CIoT EPS optimizations that are supported by the UE, the UE, as an implementation option, may indicate to lower layers to remain camped in E-UTRA cell connected to 5GCN, may then start an implementation-specific timer and enter the state 5GMM-REGISTERED.LIMITED-SERVICE. The UE may re-enable the N1 mode capability for 3GPP access at expiry of the implementation-specific timer, if the timer had been started, and may then proceed with the appropriate 5GMM procedure.

When the UE supporting both N1 mode and S1 mode needs to stay in E-UTRA connected to EPC (e.g. due to the domain selection for UE originating sessions as specified in subclause 4.3.2), in order to prevent unintentional handover or cell reselection from E-UTRA connected to EPC to NG-RAN connected to 5GCN, the UE operating in single-registration mode shall disable the N1 mode capability for 3GPP access and:

a) shall set the N1mode bit to "N1 mode for 3GPP access not supported" in the UE network capability IE (see 3GPP TS 24.301 [15]) of the ATTACH REQUEST message and the TRACKING AREA UPDATE REQUEST message in EPC; and

b) the UE NAS layer shall indicate the access stratum layer(s) of disabling of the N1 mode capability for 3GPP access.

If the UE is required to disable the N1 mode capability for 3GPP access and select E-UTRA or another RAT, and the UE is in the 5GMM-CONNECTED mode,

- if the UE has a persistent PDU session, then the UE waits until the radio bearer associated with the persistent PDU session has been released;

- otherwise the UE shall locally release the established NAS signalling connection;

and enter the 5GMM-IDLE mode before selecting E-UTRA or another RAT.

If the UE is disabling its N1 mode capability for 3GPP access before selecting E-UTRA or another RAT, the UE shall not perform the UE-initiated de-registration procedure of subclause 5.5.2.2.

The UE shall re-enable the N1 mode capability for 3GPP access when the UE performs PLMN or SNPN selection over 3GPP access, unless

- disabling of the N1 mode capability for 3GPP access was due to a UE-initiated de-registration procedure for 5GS services over 3GPP access not due to switch-off; or

- the UE has already re-enabled the N1 mode capability for 3GPP access when performing items c) or d) above.

If the disabling of N1 mode capability for 3GPP access was due to IMS voice is not available over 3GPP access and the UE's usage setting is "voice centric", the UE shall re-enable the N1 mode capability for 3GPP access when the UE's usage setting is changed from "voice centric" to "data centric", as specified in subclauses 4.3.3.

The UE should memorize the identity of the PLMN or SNPN where N1 mode capability for 3GPP access was disabled and should use that stored information in subsequent PLMN or SNPN selections as specified in 3GPP TS 23.122 [5].

If the disabling of N1 mode capability for 3GPP access was due to successful completion of an emergency services fallback, the criteria to enable the N1 mode capability again are UE implementation specific.

The UE shall disable the N1 mode capability for 3GPP access if requested by the upper layers (e.g. see subclause U.2.2.6.4 in 3GPP TS 24.229 [14]). If the UE disabled the N1 mode capability for 3GPP access based on the request from the upper layers (e.g. see subclause U.2.2.6.4 in 3GPP TS 24.229 [14]), the criteria to re-enable the N1 mode capability for 3GPP access after the completion of an emergency service are UE implementation specific.

If the N1 mode capability for 3GPP access was disabled due to the UE initiated de-registration procedure for 3GPP access or for 3GPP access and non-3GPP access and the UE is operating in single-registration mode (see subclause 5.5.2.2.3), upon request of the upper layers to re-register for 5GS services over 3GPP access the UE shall enable the N1 mode capability for 3GPP access again.

As an implementation option, the UE may start a timer for enabling the N1 mode capability for 3GPP access when the UE's registration attempt counter reaches 5 and the UE disables the N1 mode capability for 3GPP access for cases described in subclauses 5.5.1.2.7 and 5.5.1.3.7. The UE should memorize the identity of the PLMNs where N1 mode capability for 3GPP access was disabled. On expiry of this timer:

- if the UE is in Iu mode or A/Gb mode and is in idle mode as specified in 3GPP TS 24.008 [13] on expiry of the timer, the UE should enable the N1 mode capability for 3GPP access;

- if the UE is in Iu mode and a PS signalling connection exists, but no RR connection exists, the UE may abort the PS signalling connection before enabling the N1 mode capability for 3GPP access; and

- if the UE is in S1 mode and is in EMM-IDLE mode as specified in 3GPP TS 24.301 [15], on expiry of the timer, the UE should enable the N1 mode capability for 3GPP access.

If the UE is in Iu mode or A/Gb mode and an RR connection exists, the UE should delay enabling the N1 mode capability for 3GPP access until the RR connection is released. If the UE is in S1 mode and is in EMM-CONNECTED mode as specified in 3GPP TS 24.301 [15], the UE should delay enabling the N1 mode capability for 3GPP access until the NAS signalling connection in S1 mode is released.

The UE may disable the N1 mode capability for currently camped PLMN or SNPN over 3GPP access (see 3GPP TS 23.122 [5]) if no network slice is available for the camped PLMN or SNPN. If the N1 mode capability was disabled for a PLMN due to no network slice availability, and the UE receives ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST message provided with S-NSSAI and the PLMN ID in the protocol configuration options IE or extended protocol configuration options IE (see subclause 6.2.2 of 3GPP TS 24.301 [15]), the UE shall re-enable N1 mode capability for the corresponding PLMN.

If the UE attempts to establish an emergency PDU session in a PLMN where N1 mode capability was disabled due to the UE's registration attempt counter have reached 5, the UE may enable N1 mode capability for that PLMN memorized by the UE.

NOTE: If N1 mode capability is disabled due to the UE's registration attempt counter reaches 5, the value of the timer for re-enabling N1 mode capability is recommended to be the same as the value of T3502 which follows the handling specified in subclause 5.3.8.

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

### 5.3.13 Lists of 5GS forbidden tracking areas

If the UE is not operating in SNPN access operation mode, the UE shall store a list of "5GS forbidden tracking areas for roaming", as well as a list of "5GS forbidden tracking areas for regional provision of service". Otherwise the UE shall store a list of "5GS forbidden tracking areas for roaming":

- per SNPN; and

- if the UE supports access to an SNPN using credentials from a credentials holder, per entry of the "list of subscriber data" or PLMN subscription;

and store a list of "5GS forbidden tracking areas for regional provision of service":

- per SNPN; and

- if the UE supports access to an SNPN using credentials from a credentials holder, per entry of the "list of subscriber data" or PLMN subscription.

Within the 5GS, these lists are managed independently per access type, i.e., 3GPP access or wireline access. These lists shall be erased when:

a) the UE is switched off, the UICC containing the USIM is removed, an entry of the "list of subscriber data" with the subscribed SNPN identity identifying the current SNPN is updated or, if the UE supports access to an SNPN using credentials from a credentials holder, the entry of the "list of subscriber data" associated with the lists is updated; and

b) periodically (with a period in the range 12 to 24 hours).

Over 3GPP access, when the lists are erased, the UE performs cell selection according to 3GPP TS 38.304 [28] or 3GPP TS 36.304 [25C]. A tracking area shall be removed from the list of "5GS forbidden tracking areas for roaming", as well as the list of "5GS forbidden tracking areas for regional provision of service", if the UE receives the tracking area in the TAI list or the Service area list of "allowed tracking areas" in REGISTRATION ACCEPT message or a CONFIGURATION UPDATE COMMAND message. The UE shall not remove the tracking area from "5GS forbidden tracking areas for roaming" or "5GS forbidden tracking areas for regional provision of service" if the UE is registered for emergency services.

In N1 mode over 3GPP access, the UE shall update the suitable list whenever a REGISTRATION REJECT, SERVICE REJECT or DEREGISTRATION REQUEST message is received with the 5GMM cause #12 "tracking area not allowed", #13 "roaming not allowed in this tracking area", #15 "no suitable cells in tracking area", or #62 "no network slices available", or a REGISTRATION ACCEPT or SERVICE ACCEPT message is received with the forbidden TAI(s).

If a tracking area was added to the "5GS forbidden tracking areas for roaming" due to no network slice availability, and the UE receives ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST message provided with S-NSSAI and the PLMN ID in the protocol configuration options IE or extended protocol configuration options IE (see subclause 6.2.2 of 3GPP TS 24.301 [15]), the UE shall remove the corresponding tracking area from the "5GS forbidden tracking areas for roaming".

Over wireline access, the 5G-RG, the W-AGF acting on behalf of an FN-RG or the W-AGF acting on behalf of an N5GC device shall update the suitable list whenever a REGISTRATION REJECT, SERVICE REJECT or DEREGISTRATION REQUEST message is received with the 5GMM cause #12 "tracking area not allowed" or #13 "roaming not allowed in this tracking area".

NOTE: In this release of the specification, for untrusted non-3GPP access and trusted non-3GPP access, neither the list of "5GS forbidden tracking areas for roaming" nor the list of "5GS forbidden tracking areas for regional provision of service" is maintained by the UE since the UE is not able to determine the corresponding TAI.

Each list shall accommodate 40 or more TAIs. When the list is full and a new entry has to be inserted, the oldest entry shall be deleted.

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