**3GPP TSG-CT WG1 Meeting #126-eC1-20eeff**

**Electronic meeting, 15-23 October 2020 was C1-206427**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
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|  | **24.501** | **CR** | **2807** | **rev** | **1** | **Current version:** | **17.0.0** |  |
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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 |  |

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| ***Title:***  | Avoiding repeated inter-system re-directions |
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| ***Source to WG:*** | MediaTek Inc. |
| ***Source to TSG:*** | C1 |
|  |  |
| ***Work item code:*** | 5GProtoc17 |  | ***Date:*** | 2020-10-20 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)* |
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| ***Reason for change:*** | If the UE receives reject cause#31 (redirection to EPC required) and the UE cannot find suitable cell in EPC, the UE may re-enable N1 mode and proceed with 5GMM registration to the very same PLMN in 5GCN where the UE originally received reject cause #31.If the PLMN re-rejects the UE with the same cause value the UE re-attempts to select a cell from EPC and it cannot find suitable cell in EPC the same procedure goes over again and the UE starts inter-system ping-pong.To reduce the ping-pong the UE should have a timer with a sufficient value taking into account whether the UE is operating in NB-N1 mode or WB-N1 mode. |
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| ***Summary of change:*** | If the UE receives reject cause#31 (redirection to EPC required) and the UE cannot find suitable cell in EPC, the UE may remain camped in EUTRAN cell connected to 5GCN and start an implementation-specific timer. While the timer is running the N1 mode remains disabled i.e. the UE will select cells connected to EPC if available. At expiry of the implementation-specific timer the UE can re-enable N1 mode. |
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| ***Consequences if not approved:*** | Redirection to EPC and no suitable cell connected to EPC creates inter-system redirection loop. |
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| ***Clauses affected:*** | 4.9.2 |
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|  | **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:*** |  |

### 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, 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-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 reject cause #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 may indicate to lower layers to remain camped in E-UTRA cell connected to 5GCN, 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 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 may remain camped in E-UTRA cell connected to 5GCN, 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 and 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 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.

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 or A/Gb mode and an RR connection exists, the UE shall delay enabling the N1 mode capability for 3GPP access until the RR connection is released;

- 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;

- 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; and

- if the UE is in S1 mode and is in EMM-CONNECTED mode as specified in 3GPP TS 24.301 [15], on expiry of the timer, the UE shall 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.

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.