**3GPP TSG-CT WG1 Meeting #125-eC1-205546**

**Electronic meeting, 20-28 August 2020 was C1-205168**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
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|  | **24.301** | **CR** | **3438** | **rev** | **1** | **Current version:** | **16.5.1** |  |
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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 inter-system ping-pong due to redirection |
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| ***Source to WG:*** | MediaTek Inc., OPPO? |
| ***Source to TSG:*** | C1 |
|  |  |
| ***Work item code:*** | 5G\_CIoT |  | ***Date:*** | 2020-08-27 |
|  |  |  |  |  |
| ***Category:*** | **C** |  | ***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)Rel-17 (Release 17)* |
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| ***Reason for change:*** | If the UE receives reject cause#31 (redirection to 5GCN required) and the UE cannot find suitable cell in 5GCN, the UE may re-enable S1 mode and proceed with EMM registration to the very same PLMN in EPC where the UE originally received reject cause #31.If the PLMN in 5GCN re-rejects the UE with the same cause value the same procedure goes over again and the UE starts inter-system ping-pong. |
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| ***Summary of change:*** | For NB-S1 mode UE, for re-registration to the same PLMN after reject #31, to reduce inter-system ping-pong the UE should not attempt EMM procedures to the network that has sent reject #31, until a period of time is elapsed. Meanwhile, as normal, the UE is allowed to select highest priority network or system elsewhere.For WB-S1 mode UE, for re-registration to the same PLMN after reject #31, the UE can disable CIoT 5GS optimizations in order to avoid repeated redirection to 5GCN. |
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| ***Consequences if not approved:*** | If redirection to another system fails after rejected with reject cause #31 the UE starts inter-system ping-pong loop. |
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| ***Clauses affected:*** | 4.5 |
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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 ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

## 4.5 Disabling and re-enabling of UE's E-UTRA capability

The UE shall only disable the E-UTRA capability when in EMM-IDLE mode.

When the UE supports both N1 mode and S1 mode then the UE's capability to access the 5GCN via E-UTRA shall not be affected, if the UE's E-UTRA capability is disabled or enabled.

When the UE is disabling the E-UTRA capability not due to redirection to 5GCN required, it should proceed as follows:

a) select another RAT (GERAN, UTRAN, or NG-RAN if the UE has not disabled its N1 mode capability for 3GPP access as specified in 3GPP TS 24.501 [54]) of the registered PLMN or a PLMN from the list of equivalent PLMNs;

b) 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 perform PLMN selection as specified in 3GPP TS 23.122 [6]. As an implementation option, instead of performing PLMN selection, the UE may select another RAT of the chosen PLMN. If disabling of E-UTRA capability was not due to UE initiated detach procedure for EPS services only, the UE may re-enable the E-UTRA capability for this PLMN selection; or

c) if no other allowed PLMN and RAT combinations are available, then the UE may re-enable the E-UTRA capability and remain registered for EPS services in E-UTRAN of the registered PLMN. If the UE chooses this option, then it may periodically attempt to select another PLMN and RAT combination that can provide non-EPS services. How this periodic scanning is done, is UE implementation dependent.

When the UE is disabling the E-UTRA capability upon receiving reject cause #31 "Redirection to 5GCN required" as specified in subclauses 5.5.1.2.5, 5.5.1.3.5, 5.5.3.2.5, 5.5.3.3.5 and 5.6.1.5, it should proceed as follows:

i) If the UE is in NB-S1 mode:

1) if lower layers do not provide an indication that the current E-UTRA cell is connected to 5GCN or lower layers do not provide an indication that the current E-UTRA cell supports CIoT 5GS optimizations that are supported by the UE, search for a suitable NB-IoT cell connected to 5GCN according to 3GPP TS 36.304 [21];

2) if lower layers provide an indication that the current E-UTRA cell is connected to 5GCN and the current E-UTRA cell supports CIoT 5GS optimizations that are supported by the UE then perform a core network selection to select 5GCN as specified in 3GPP TS 24.501 [54] subclause 4.8.4A.1; or

3) if lower layers cannot find a suitable NB-IoT cell connected to 5GCN or there is no suitable NB-IoT cell connected to 5GCN which supports CIoT 5GS optimizations that are supported by the UE, the UE may proceed as follows:

i) if a suitable E-UTRA cell connected to EPC in a PLMN where reject cause #31 was received is still available, camp on that cell, not proceed with a EMM procedure and start an implementation-specific timer. At the expiry of that timer, or after switching off or USIM removal, the UE may re-enable the E-UTRA capability and proceed with an appropriate EMM procedure;

ii) if no suitable E-UTRA cell connected to EPC in a PLMN where reject cause #31 was received is available, initiate PLMN selection procedures as specified in 3GPP TS 23.122 [5], and if a suitable E-UTRA cell connected to EPC is found in another PLMN, re-enable the E-UTRA capability and proceed with an appropriate EMM procedure; and

iii) otherwise start an implementation specific timer and at expiry of the timer, or after switching off or USIM removal, the UE may re-enable the E-UTRA capability and proceed with an appropriate EMM procedure.

ii) If the UE is in WB-S1 mode:

1) if lower layers do not provide an indication that the current E-UTRA cell is connected to 5GCN or lower layers do not provide an indication that the current E-UTRA cell supports CIoT 5GS optimizations that are supported by the UE, search for a suitable E-UTRA cell connected to 5GCN according to 3GPP TS 36.304 [21];

2) if lower layers provide an indication that the current E-UTRA cell is connected to 5GCN and the current E-UTRA cell supports CIoT 5GS optimizations that are supported by the UE, then perform a core network selection to select 5GCN as specified in 3GPP TS 24.501 [54] subclause 4.8.4A.1; or

3) if lower layers cannot find a suitable E-UTRA cell connected to 5GCN or there is no suitable E-UTRA cell connected to 5GCN which supports CIoT 5GS optimizations that are supported by the UE, the UE may re-enable the E-UTRA capability, and indicate to lower layers to remain camped in E-UTRA connected to EPC of the previously registered PLMN and proceed with the appropriate EMM procedure. As part of that attach or tracking area updating procdure, to avoid the unnecessary redirection failures, the UE may set both Control plane CIoT 5GS optimization bit and User plane CIoT 5GS optimization bit in the N1 UE network capability IE to "Control plane CIoT 5GS optimization not supported" and "User plane CIoT 5GS optimization not supported" respectively and further set the 5GS Preferred CIoT network behaviour bit in the EPS update type IE to "no additional information".

The UE shall re-enable the E-UTRA capability when performing a PLMN selection unless:

- the disabling of E-UTRA capability was due to UE initiated detach procedure for EPS services only; or

- the UE has already re-enabled the E-UTRA capability when performing bullets b) or c) above.

If due to handover, the UE moves to a new PLMN in A/Gb, Iu, or N1 mode which is not in the list of equivalent PLMNs and not a PLMN memorized by the UE for which E-UTRA capability was disabled, and the disabling of E-UTRA capability was not due to UE initiated detach procedure for EPS services only, the UE shall re-enable the E-UTRA capability after the RR/RRC connection is released.

If UE that has disabled its E-UTRA capability due to IMS voice not available and CS fallback not available re-enables it when PLMN selection is performed, then it should memorize the identity of the PLMNs where E-UTRA capability was disabled and use that stored information in subsequent PLMN selections as specified in 3GPP TS 23.122 [6].

The UE may support "E-UTRA Disabling for EMM cause #15" and implement the following behaviour:

- if the "E-UTRA Disabling Allowed for EMM cause #15" parameter as specified in 3GPP TS 24.368 [15A] or 3GPP TS 31.102 [17] is present and set to enabled; and

- if the UE receives an ATTACH REJECT or TRACKING AREA UPDATE REJECT message including both EMM cause #15 "no suitable cells in tracking area" and an Extended EMM cause IE with value "E-UTRAN not allowed";

then the UE shall disable the E-UTRA capability, memorize the identity of the PLMN where the E-UTRA capability was disabled and use that stored information in subsequent PLMN selections as specified in 3GPP TS 23.122 [6].

When the UE supporting the A/Gb and/or Iu mode together with the S1 mode needs to stay in A/Gb or Iu mode, in order to prevent unwanted handover or cell reselection from UTRAN/GERAN to E-UTRAN, the UE shall disable the E-UTRA capability and:

- The UE shall not set the E-UTRA support bits of the MS Radio Access capability IE (see 3GPP TS 24.008 [13], subclause 10.5.5.12a), the E-UTRA support bits of Mobile Station Classmark 3 IE (see 3GPP TS 24.008 [13], subclause 10.5.1.7), the PS inter-RAT HO from GERAN to E-UTRAN S1 mode capability bit and the ISR support bit of the MS network capability IE (see 3GPP TS 24.008 [13], subclause 10.5.5.12) in the ATTACH REQUEST message and the ROUTING AREA UPDATE REQUEST message after it selects GERAN or UTRAN;

- the UE shall use the same value of the EPC capability bit of the MS network capability IE (see 3GPP TS 24.008 [13], subclause 10.5.5.12) in the ATTACH REQUEST message and the ROUTING AREA UPDATE REQUEST message; and

- the UE NAS layer shall indicate the access stratum layer(s) of disabling of the E-UTRA capability.

When the UE supporting N1 mode together with S1 mode needs to stay in N1 mode, in order to prevent unwanted handover or cell reselection from NG-RAN to E-UTRAN, the UE shall disable the E-UTRA capability and:

- the UE shall set the S1 mode bit to "S1 mode not supported" in the 5GMM Capability IE of the REGISTRATION REQUEST message (see 3GPP TS 24.501 [54]);

- the UE shall not include the S1 UE network capability IE in the REGISTRATION REQUEST message (see 3GPP TS 24.501 [54]); and

- the UE NAS layer shall indicate the access stratum layer(s) of disabling of the E-UTRA capability.

If the UE is disabling its E-UTRA capability before selecting to GERAN, UTRAN or NG-RAN radio access technology, the UE shall not perform the detach procedure of subclause 5.5.2.1.

If the UE is required to disable the E-UTRA capability and select GERAN, UTRAN or NG-RAN radio access technology, and the UE is in the EMM-CONNECTED mode, the UE shall locally release the established NAS signalling connection and enter the EMM-IDLE mode before selecting GERAN, UTRAN or NG-RAN radio access technology.

If the E-UTRA capability was disabled due to the attempt to select GERAN or UTRAN radio access technology progressing the CS emergency call establishment (see subclause 4.3.1), the criteria to enable the E-UTRA capability again is UE implementation specific.

If the E-UTRA capability was disabled due to the UE initiated detach procedure for EPS services only (see subclause 5.5.2.2.2), upon request of the upper layers to re-attach for EPS services the UE shall enable the E-UTRA capability again. If the E-UTRA capability was disabled due to receipt of EMM cause #14 "EPS services not allowed in this PLMN", then the UE shall enable the E-UTRA capability when the UE powers off and powers on again or the USIM is removed. If E-UTRA capability was disabled for any other reason, the UE shall enable the E-UTRA capability in the following cases:

- the UE mode of operation changes from CS/PS mode 1 of operation to CS/PS mode 2 of operation;

- the UE mode of operation changes from PS mode 1 of operation to PS mode 2 of operation; or

- the UE powers off and powers on again or the USIM is removed;

As an implementation option, the UE may start a timer for enabling E-UTRA when the UE's attach attempt counter or tracking area updating attempt counter reaches 5 and the UE disables E-UTRA capability for cases described in subclauses 5.5.1.2.6, 5.5.1.3.4.3, 5.5.1.3.6, 5.5.3.2.6, 5.5.3.3.4.3 and 5.5.3.3.6. The UE should memorize the identity of the PLMNs where E-UTRA capability were 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 E-UTRA capability;

- if the UE is in Iu mode or A/Gb mode and an RR connection exists, the UE shall delay enabling E-UTRA capability 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 E-UTRA capability;

- if the UE is in N1 mode and is in 5GMM-IDLE mode as specified in 3GPP TS 24.501 [54], on expiry of the timer, the UE should enable the E-UTRA capability; and

- if the UE is in N1 mode and is in 5GMM-CONNECTED mode as specified in 3GPP TS 24.501 [54], on expiry of the timer, the UE shall delay enabling the E-UTRA capability until the N1 NAS signalling connection is released.

If the UE attempts to establish an emergency bearer service in a PLMN where the E-UTRA capability was disabled due to the UE's attach attempt counter or tracking area updating attempt counter have reached 5, the UE may enable the E-UTRA capability for that PLMN memorized by the UE.

For other cases, it is up to the UE implementation when to enable the E-UTRA capability.

NOTE: If the UE is not operating in CS/PS mode 1 operation, the value of the timer for enabling E-UTRA capability is recommended to be not larger than the default value of T3402.

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