**TSG SA Meeting #87-e SP-200268**

**e-meeting, 17-20 March 2020 (was S2-2002355)**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
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|  | **23.501** | **CR** | **2179** | **rev** | **2** | **Current version:** | **16.3.0** |  |
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| *For* ***HE******LP*** *on using this form: comprehensive instructions can be found at 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:***  | Change of the restriction of enhanced coverage |
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| ***Source to WG:*** | Qualcomm Incorporated, [Samsung, Interdigital Inc, Ericsson] |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | 5G\_CIoT |  | ***Date:*** | 2020-03-17 |
|  |  |  |  |  |
| ***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. | *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:*** | The restriction on the use of enhanced coverage can change e.g. due to changes in subscription information. When this occurs for a UE, the AMF will apply the corresponding NAS timers, and for every PDU session that is established the AMF informs the SMF about the change so that the SMF also applies the corresponding NAS timers. This is specified in section 5.31.12 of TS 23.501. And currently AMF can inform UE of the updated restriction of enhanced coverage during registration procedure. However, following two cases may avoid the registration procedure:* CM-CONNECTED mode will not necessarily perform a registration procedure and hence cannot be informed about the change in a Registration Accept message,
* CM-IDLE mode may transition to CM-CONNECTED mode with a service request procedure and again the network will not be able to inform the UE about the change as a registration procedure may not be triggered over a long period of time as such transitions will reset the periodic registration update timer.

Therefore, a mechanism is needed to inform the UE that is in CM-CONNECTED mode about this change. This should be similar to what is already done e.g. for updates related to the use of MICO with the UCU procedure. |
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| ***Summary of change:*** | Clarify that when a change regarding the use of coverage enhancement occurs (e.g. due to a change in subscription) and the UE is in CM-CONNECTED, the AMF shall trigger the UE Configuration Update procedure to the UE. The AMF also updates SMFs to apply extended NAS-SM timer as part of the registration procedure. |
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| ***Consequences if not approved:*** | The UE and network (AMF and SMF) are not synchronized with respect to the NAS timer value range that should be used after changes in the use of enhanced coverage for the UE. |
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| ***Clauses affected:*** | 5.31.12 |
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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:*** |  |
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| ***This CR's revision history:*** | Rev.2: * There is no need for re-registration triggered from the UE Configuration Update
* There is no need for updating the RAN. Changes in the Enhanced Coverage Restriction shall not be applied in RAN when the UE is in CM-CONNECTED (ref. LS from RAN2 S2-167117 stated: “Authorization of coverage enhancements will not impact specifications for connected mode mobility (i.e. left to network implementation). In case Idle mode procedures apply in connected mode (e.g. RRC re-establishment) the Idle mode procedure handling of authorization of coverage enhancements applies.”
* Changes in SM timers in UE and SMF shall apply when the UE moves to IDLE
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\*\*\* FIRST CHANGES \*\*\*

### 5.31.12 Restriction of use of Enhanced Coverage

Support of UEs in Enhanced Coverage is specified in TS 36.300 [30].

The usage of Enhanced Coverage requires use of extensive resources (e.g. radio and signalling resources). Specific subscribers can be restricted to use Enhanced Coverage feature through Enhanced Coverage Restricted information that is stored in the UDM as part of subscription data and specifies per PLMN whether the Enhanced Coverage functionality is restricted or not for the UE. Enhanced Coverage Restricted information indicates whether CE mode B is restricted for the UE, or both CE mode A and CE mode B are restricted for the UE, or both CE mode A and CE mode B are not restricted for the UE.

The AMF receives Enhanced Coverage Restricted information from the UDM during the Registration procedure. The AMF based on local configuration, UE Usage setting, UE subscription information and network policies, or any combination of them, determines whether Enhanced Coverage (i.e. CE mode B or both CE mode B & CE mode A) is restricted for the UE and stores updated Enhanced Coverage Restriction information in the UE context in the AMF. If the UE usage setting indicated that UE is "voice centric", then the AMF shall set CE mode B restricted for the UE in Enhanced Coverage Restriction information.

If the UE includes the support for restriction of use of Enhanced Coverage, the AMF sends Enhanced Coverage Restricted information to the UE in the Registration Accept message. The UE shall use the value of Enhanced Coverage Restricted information to determine if enhanced coverage feature is restricted or not. The AMF provides an Enhanced Coverage Restricted information to the RAN via N2 signalling whenever the UE context is established in the RAN, e.g. during N2 Paging procedure, Service Request procedure, Initial Registration and Periodic Registration procedure.

For roaming UEs, if the UDM doesn't provide any Enhanced Coverage Restricted information or the provided Enhanced Coverage Restricted information is in conflict with the roaming agreement, the AMF uses default Enhanced Coverage Restricted information locally configured in the VPLMN based on the roaming agreement with the subscriber's HPLMN.

The UE indicates its capability of support for restriction of use of Enhanced Coverage to the AMF in the Registration procedure for the RAT it is camping on. The UE that indicates its support Enhanced Coverage over N1 interface shall also support restriction of the Enhanced Coverage over N1 interface.

The UE shall assume that restriction for use of Enhanced Coverage is the same in the equivalent PLMNs.

If the UE supports CE mode B and use of CE mode B is not restricted according to the Enhanced Coverage Restriction information in the UE context in the AMF, then the AMF shall use the extended NAS-MM timer setting for the UE as specified in TS 24.501 [47] and shall send the extended NAS-SM timer indication during PDU session establishment to the SMF.

If the UE supports CE mode B and use of CE mode B changes from restricted to unrestricted or vice versa in the Enhanced Coverage Restriction information in the UE context in the AMF (e.g. due to a subscription change) then:

- The AMF determines when to enforce the change of restriction of use of Enhanced Coverage.

- When the UE is in CM-CONNECTED mode, the AMF can use the UE Configuration Update procedure, as specified in step 3a of clause 4.2.4.2 of TS 23.502 [3], to trigger a mobility registration update procedure in CM-CONNECTED mode for the AMF to inform the change of restriction of Enhanced Coverage towards the UE.

- If the UE has already established PDU sessions, then the AMF shall trigger a PDU session modification to the SMFs serving the UE's PDU sessions to update the use of the extended NAS-SM timer setting as described in step 1f of clause 4.3.3.2 of TS 23.502 [3] when the AMF determines that NAS-SM timer shall be updated due to the change of Enhanced Coverage Restriciton.

- The UE and network applies the new Enhanced Coverage Restriction information after mobility registration procedure is completed.

Based on the extended NAS-SM timer indication, the SMF shall use the extended NAS-SM timer setting for the UE as specified in TS 24.501 [47].

The support for Enhanced Coverage Restriction Control via NEF enables AF to query status of Enhanced Coverage Restriction or enable/disable Enhanced Coverage Restriction per individual UEs. The procedure for Enhanced Coverage Restriction Control via NEF is described in clause 4.27 of TS 23.502 [3].

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