**3GPP TSG-CT WG1 Meeting #136-e *Rev\_*C1-223663**

**E-Meeting, 12th – 20th May 2022**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **24.501** | **CR** | **4357** | **rev** | **1** | **Current version:** | **17.6.1** |  |
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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 |  | Radio Access Network |  | Core Network | **X** |

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| ***Title:***  | Abnormal cases in Registration procedure for handling Paging subgroup ID |
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| ***Source to WG:*** | Apple |
| ***Source to TSG:*** | C1 |
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| ***Work item code:*** | 5GProtoc17, NR\_UE\_pow\_sav\_enh |  | ***Date:*** | 2022-04-30 |
|  |  |  |  |  |
| ***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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | If the UE supports NR Paging subgrouping and the network supports and accepts the use of the PEIPS assistance information for the UE, the network provides to the UE the Negotiated PEIPS assistance information, including the Paging subgroup ID, in the REGISTRATION ACCEPT message. The Paging subgroup ID is used to determine the NR paging subgroup for paging the UE.There can be a lower layer failure when delivering the REGISTRATION COMPLETE message. If the network does not receive the REGISTRATION COMPLETE message due to a lower layer failure, the UE and network are out of sync as to which negotiated Paging subgroup ID to use. There needs to be appropriate handling of this abnormal case, so that both the UE and network are in sync with respect to the UE paging configurationand that the network can continue to deliver Paging messages to UE in a deterministic and efficient manner. |
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| ***Summary of change:*** |  In case of lower layer failure and if the network does not receive the REGISTRATION COMPLETE message, the network should consider two different Paging subgroup IDs. Each of these Paging subgroup ID is associated with a corresponding GUTI as well. The network should page the UE with both the Paging subgroup IDs and based on the GUTI included in the message with which the UE responds, use the Paging subgroup ID associated with that GUTI, and consider the other Paging subgroup ID as invalid. |
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| ***Consequences if not approved:*** | The Registration procedure was not completed successfully. The UE and network are out of sync with regards to UE paging configuration and use of appropriate Paging subgroup ID. As such the UE may miss paging messages leading to service degradation on UE and poor paging KPI from the network side. |
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| ***Clauses affected:*** | 5.5.1.3.8 |
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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:*** |  |

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

##### 5.5.1.3.8 Abnormal cases on the network side

The following abnormal cases can be identified:

a) If a lower layer failure occurs before the message REGISTRATION COMPLETE has been received from the UE and timer T3550 is running, the AMF shall abort the procedure, enter 5GMM-IDLE mode.

 If a new 5G-GUTI was assigned to the UE in the REGISTRATION ACCEPT message, the AMF shall consider both, the old and new 5G-GUTIs as valid until the old 5G-GUTI can be considered as invalid by the AMF. If a new TAI list was provided in the REGISTRATION ACCEPT message, both the old and new TAI lists shall also be considered valid until the old TAI list can be considered invalid by the AMF. If the old 5G-GUTI was allocated by an AMF other than the current AMF, the current AMF does not need to retain the old 5G-GUTI.

 Additionally, if the REGISTRATION ACCEPT message includes:

1) Negotiated PEIPS assistance information IE containing a new Paging subgroup ID and the UE is previously assigned a different Paging subgroup ID then, the AMF shall consider both, the old and new Paging subgroup IDs as valid until the old Paging subgroup ID can be considered as invalid by the AMF; or

2) Negotiated PEIPS assistance information IE containing no Paging subgroup ID or no Negotiated PEIPS assistance information IE, then the AMF shall delete any old Paging subgroup ID stored in the 5GMM context of the UE.

During this period:

1) if the new 5G-GUTI is used by the UE in a subsequent message, then:

i) the AMF shall consider the old 5G-GUTI as invalid and, additionally, the old TAI list as invalid if a new TAI list was provided with the new 5G-GUTI in the REGISTRATION ACCEPT message; and

ii) if the AMF assigns a new Paging subgroup ID to the UE in the REGISTRATION ACCEPT message, then, the AMF shall consider the new Paging subgroup ID as valid and the old Paging subgroup ID, if any, as invalid.

2) if the old 5G-GUTI is used by the UE in a subsequent message, the AMF may use the identification procedure followed by a generic UE configuration update procedure. If the AMF in the REGISTRATION ACCEPT message:

i) assigns a new Paging subgroup ID to the UE, then, the AMF shall include the PEIPS assistance information; or

ii) does not assign a Paging subgroup ID to the UE then, the AMF shall not include the PEIPS assistance information;

and initiate the generic UE configuration update procedure; and

3) if the UE needs to be paged:

i) if in the REGISTRATION ACCEPT message:

- a new Paging subgroup ID is assigned to the UE that previously has no Paging subgroup ID assigned then, the AMF shall use the new Paging subgroup ID for paging the UE;

- a new Paging subgroup ID is assigned to the UE that is same as the old Paging subgroup ID then, the AMF shall use the same Paging subgroup ID for paging the UE; and

- a new Paging subgroup ID was assigned to the UE that is different than the old Paging subgroup ID then, the AMF may first use the old Paging subgroup ID followed by the new Paging subgroup ID for paging the UE.

ii) the AMF selects the 5G-GUTI and TAI list as follows:

- the AMF may first use the old 5G-S-TMSI from the old 5G-GUTI for paging within the area defined by the old TAI list for an implementation dependent number of paging attempts using the selected Paging subgroup ID. If a new TAI list was provided in the REGISTRATION ACCEPT message, the new TAI list should also be used for paging. Upon response from the UE, the AMF may initiate the generic UE configuration update procedure. If the response is received from a tracking area within the old and new TAI list, the network shall initiate the generic UE configuration update procedure. If in the REGISTRATION ACCEPT message a new Paging subgroup ID was assigned to the UE that is different than the old Paging subgroup ID then the network shall initiate the generic UE configuration update procedure; and

- if no response is received to the paging attempts using the old 5G-S-TMSI from the old 5G-GUTI and the old Paging subgroup ID, the AMF may use the new 5G-S-TMSI from the new 5G-GUTI and the new Paging subgroup ID, if any, for paging, for an implementation dependent number of paging attempts. In this case, if a new TAI list was provided with the new 5G-GUTI in the REGISTRATION ACCEPT message, the new TAI list shall be used instead of the old TAI list.

b) Protocol error.

 If the REGISTRATION REQUEST message has been received with a protocol error, the AMF shall return a REGISTRATION REJECT message with one of the following 5GMM cause values:

#96 invalid mandatory information;

#99 information element non-existent or not implemented;

#100 conditional IE error; or

#111 protocol error, unspecified.

c) T3550 time out.

 On the first expiry of the timer, the AMF shall retransmit the REGISTRATION ACCEPT message and shall reset and restart timer T3550. The retransmission is performed four times, i.e. on the fifth expiry of timer T3550, the registration procedure for mobility and periodic update procedure is aborted.

 If a new 5G-GUTI was assigned to the UE in the REGISTRATION ACCEPT message, both, the old and new 5G-GUTI shall be considered as valid until the old 5G-GUTI can be considered as invalid by the AMF. If a new TAI list was provided in the REGISTRATION ACCEPT message, both the old and new TAI lists shall also be considered valid until the old TAI list can be considered invalid by the AMF. If the old 5G-GUTI was allocated by an AMF other than the current AMF, the current AMF does not need to retain the old 5G-GUTI. During this period the AMF acts as described for case a) above.

d) REGISTRATION REQUEST with 5GS registration type IE set to "mobility registration updating" or "periodic registration updating" received after the REGISTRATION ACCEPT message has been sent and before the REGISTRATION COMPLETE message is received, if the REGISTRATION COMPLETE message is expected.

1) If one or more of the information elements in the REGISTRATION REQUEST message differ from the ones received within the previous REGISTRATION REQUEST message, the previously initiated registration procedure for mobility and periodic registration update shall be aborted if the REGISTRATION COMPLETE message has not been received and the new registration procedure for mobility and periodic registration update shall be progressed; or

2) if the information elements do not differ, then the REGISTRATION ACCEPT message shall be resent and timer T3550 shall be restarted. In that case, the retransmission counter related to timer T3550 is not incremented.

e) More than one REGISTRATION REQUEST message with 5GS registration type IE set to "mobility registration updating" or "periodic registration updating" received and neither REGISTRATION ACCEPT message nor REGISTRATION REJECT message has been sent.

1) If one or more of the information elements in the REGISTRATION REQUEST message differs from the ones received within the previous REGISTRATION REQUEST message, the previously initiated registration procedure for mobility and periodic registration update shall be aborted and the new registration procedure for mobility and periodic registration update shall be progressed; or

2) if the information elements do not differ, then the network shall continue with the previous registration procedure for mobility and periodic registration update and shall not treat any further this REGISTRATION REQUEST message.

f) Lower layers indication of non-delivered NAS PDU due to handover.

 If the REGISTRATION ACCEPT message or REGISTRATION REJECT message could not be delivered due to an intra AMF handover and the target TA is included in the TAI list, then upon successful completion of the intra AMF handover the AMF shall retransmit the REGISTRATION ACCEPT message or REGISTRATION REJECT message. If a failure of the handover procedure is reported by the lower layer and the N1 NAS signalling connection exists, the AMF shall retransmit the REGISTRATION ACCEPT message or REGISTRATION REJECT message.

g) DEREGISTRATION REQUEST message received before REGISTRATION COMPLETE message is received, if the REGISTRATION COMPLETE message is expected.

 If the De-registration type IE is set to "switch off":

 The AMF shall abort the signalling for the registration procedure for mobility and periodic update towards the UE and shall progress the de-registration procedure as described in subclause 5.5.2.2.

NOTE 1: Internally in the AMF, before processing the de-registration request, the AMF can perform the necessary signalling procedures for the registration procedure for mobility and periodic update before progressing the de-registration procedure.

 If the De-registration type IE is set to other type than "switch off":

 The AMF shall proceed with registration procedure for mobility and periodic update and shall progress the de-registration procedure after successful completion of the registration procedure for mobility and periodic update.

h) If the REGISTRATION REQUEST message with 5GS registration type IE indicating "periodic registration updating" is received by the new AMF which does not have the 5GMM context data related to the subscription, the new AMF may send the REGISTRATION REJECT message with 5GMM cause #10 "implicitly de-registered".

i) Based on operator policy, if the mobility and periodic registration update request from a UE not supporting CAG is rejected due to CAG restrictions, the network shall reject the mobility and periodic registration update request with a 5GMM cause value other than the 5GMM cause #76 (Not authorized for this CAG or authorized for CAG cells only).

NOTE 2: 5GMM cause #7 (5GS services not allowed), 5GMM cause #11 (PLMN not allowed), 5GMM cause #27 (N1 mode not allowed), 5GMM cause #73 (Serving network not authorized) can be used depending on the subscription of the UE and whether the UE roams or not.

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