**3GPP TSG-CT WG1 Meeting #128-eC1-211207**

**Electronic meeting, 25 February – 5 March 2021**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **24.501** | **CR** | **3024** | **rev** | **1** | **Current version:** | **17.1.0** |  |
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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:***  | T3540 |
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| ***Source to WG:*** | Samsung, InterDigital |
| ***Source to TSG:*** | C1 |
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| ***Work item code:*** | 5GProtoc17 |  | ***Date:*** | 2021-02-17 |
|  |  |  |  |  |
| ***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:*** | T3540 is always set to 10s.Assume a UE in NB-N1 mode for which coverage enhancement is not restricted. All 5GMM timers are extended by 240s as described in section 4.17 of TS 24.501.T3540 should be extended as well based on the whether enhanced coverage, or CE Mode B, etc, is restricted or not. To demonstrate why this is needed, consider the following scenario:a) UE is paged e.g. due to DL signaling, such as 5GSM messageb) UE responds to paging and receives Service Acceptc) UE starts T3540 (= 10s) per conditions shown below from section 5.3.1.3 in the spec:“f) shall start the timer T3540 if:1) the UE receives a SERVICE ACCEPT message;2) the UE did not set the Service type IE to "signalling" or "high priority access", the UE has not included the Uplink data status IE in the SERVICE REQUEST message, or the UE has included the Uplink data status IE in the SERVICE REQUEST message but the SERVICE REQUEST message indicates that no user-plane resources of any PDU sessions are to be re-established;3) the UE has not included the Allowed PDU session status IE or has included the Allowed PDU session status IE indicating there is no PDU session(s) for which the UE allowed the user-plane resource to be re-established over 3GPP access in the SERVICE ACCEPT message, or the UE has included the Allowed PDU session status IE in the SERVICE REQUEST message but the SERVICE ACCEPT message does not indicate that any user-plane resources of any PDU sessions are to be re-established;4) the service request procedure has been initiated in 5GMM-IDLE mode;5) the user-plane resources for PDU sessions have not been set up; and6) the UE need not request resources for V2X communication over PC5 reference point (see 3GPP TS 23.287 [6C]);”**Reason #1 for extending T3540**The following requirement is in place regarding 5G-GUTI reallocation from section 5.4.4.1 of the spec:“This procedure shall be initiated by the network to assign a new 5G-GUTI to the UE after:a) a successful service request procedure invoked as a response to a paging request from the network and **before the**:1) **release of the N1 NAS signalling connection**; or2) suspension of the N1 NAS signalling connection due to user plane CIoT 5GS optimization i.e. before the UE and the AMF enter 5GMM-IDLE mode with suspend indication; or”The timer T3555 which is started at the AMF after sending the Configuraiton Update Command (CUC) message will be set to 246s (240 + 6) for a UE in NB-N1 mode. On the other hand, T3540 is only 10s which surely means that the NAS signaling connection will be released if the CUC message does not arrive within 10s. It is obvious that the CUC message is not expected to arrive within 10s otherwise the T3555 will not be set to 246s in this case.As such, expiry of T3540 and consequently the release of the NAS connection will render the allocation of a new 5G-GUTI **before the release of the N1 NAS signalling connection** impossible.Note that the same issue can happen when CE mode B is not restricted in WB mode. In this case, the timer T3555 will be set to 24s and so the UE which does not receive the CUC message by 10s (which is the length of T3540) will release the N1 NAS signalling connection, and this again would render the allocation of a new 5G-GUTI **before the release of the N1 NAS signalling connection** impossible.The above will lead to cases in which the UE will be paged two consecutive times with the same 5G-GUTI which is not supposed to happen per the existing requirements shown above. This is the main reason why T3540 needs to be extended if the UE is also extending other timers as well. Otherwise user privacy will be jeopardized.**Reason #2 for extending T3540**For other cases that the UE starts T3540, including the need to deliver e.g. 5GSM message after the UE is paged, it becomes very likely that no DL message can be delivered to the UE e.g. when coverage enhancement is not restricted, at least in NB-N1 mode. This is because everytime the UE is paged, UE responds to paging, UE gets Service Accept, etc, and T3540 is started, then T3540 will very highly likely always expire before the message from the AMF arrives. This may keep repeating a few times without any success. To avoid the issues described above, T3540 needs to be extended (when other NAS timers are extended) so as to give the UE a chance to receive a DL message from the AMF after T3540 is started. |
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| ***Summary of change:*** | T3540 is extended by 240s (total 250s) if coverage enhancement is used in NB-N1 mode. This is clarified with the corresponding NOTE in the timer table in section 10.2 (applicable to case f) in subclause 5.3.1.3).T3540 is extended by 24s (total 34s) if coverage enhancement is used in WB-N1 mode. This gives enough time for CUC message to arrive. This is clarified with the corresponding NOTE in the timer table in section 10.2 (applicable to case f) in subclause 5.3.1.3). |
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| ***Consequences if not approved:*** | When coverage enhancement (and/or CE mode B, and/or CE mode A and CE mode B) is not restricted, allocating as new 5G-GUTI after paging cannot be guaranteed as required, thereby user privacy is jeopardized.Delivery of DL signaling after paging (or other cases when T3540 is started) may constantly fail at least for the case of NB-N1 mode. |
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| ***Clauses affected:*** | 10.2 |
|  |  |
|  | **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:*** |  |

**\*\*\*\*\* START CHANGE \*\*\*\*\***

## 10.2 Timers of 5GS mobility management

Timers of 5GS mobility management are shown in table 10.2.1 and table 10.2.2

NOTE: Timers T3324, T3346 and T3245 are defined in 3GPP TS 24.008 [12]. Timers T3444, T3445, T3447 and T3448 are defined in 3GPP TS 24.301 [15].

Table 10.2.1: Timers of 5GS mobility management – UE side

| TIMER NUM. | TIMER VALUE | STATE | CAUSE OF START | NORMAL STOP | ON EXPIRY |
| --- | --- | --- | --- | --- | --- |
| T3502 | Default 12 min.NOTE 1 | 5GMM-DEREGISTERED 5GMM-REGISTERED | At registration failure and the attempt counter is equal to 5 | Transmission of REGISTRATION REQUEST message | Initiation of the registration procedure, if still required |
| T3510 | 15sNOTE 7NOTE 8In WB-N1/CE mode, 85s | 5GMM-REGISTERED-INITIATED | Transmission of REGISTRATION REQUEST message | REGISTRATION ACCEPT message received or REGISTRATION REJECT message received | Start T3511 or T3502 as specified in subclause 5.5.1.2.7 if T3510 expired during registration procedure for initial registration.Start T3511 or T3502 as specified in subclause 5.5.1.3.7 if T3510 expired during the registration procedure for mobility and periodic registration update |
| T3511 | 10s | 5GMM-DEREGISTERED.ATTEMPTING-REGISTRATION5GMM-REGISTERED.ATTEMPTING-REGISTRATION-UPDATE5GMM-REGISTERED.NORMAL-SERVICE | At registration failure due to lower layer failure, T3510 timeout or registration rejected with other 5GMM cause values than those treated in subclause 5.5.1.2.5 for initial registration or subclause 5.5.1.3.5 for mobility and periodic registration | Transmission of REGISTRATION REQUEST message5GMM-CONNECTED mode entered (NOTE 5) | Retransmission of the REGISTRATION REQUEST, if still required |
| T3512 | Default 54 minNOTE 1NOTE 2 | 5GMM-REGISTERED | In 5GMM-REGISTERED, when 5GMM-CONNECTED mode is left and if the NW does not indicate support for strictly periodic registration timer as specified in subclause 5.3.7.If the network indicates support for strictly periodic registration timer, T3512 is started after the successful completion of registration update procedure. T3512 is restarted if it expires in 5GMM-CONNECTED mode as specified in subclause 5.3.7. | When entering state 5GMM-DEREGISTERED When entering 5GMM-CONNECTED mode if the NW does not indicate support for strictly periodic registration timer as specified in subclause 5.3.7. | In 5GMM-IDLE mode, Initiation of the periodic registration procedure if the UE is not registered for emergency services.In 5GMM-CONNECTED mode, restart the timer T3512.Locally deregister if the UE is registered for emergency services |
| T3516 | 30sNOTE 7NOTE 8In WB-N1/CE mode, 48s | 5GMM-REGISTERED-INITIATED5GMM-REGISTERED5GMM-DEREGISTERED-INITIATED5GMM-SERVICE-REQUEST-INITIATED | RAND and RES\* stored as a result of an 5G authentication challenge | SECURITY MODE COMMAND receivedSERVICE REJECT receivedREGISTRATION ACCEPT receivedAUTHENTICATION REJECT receivedAUTHENTICATION FAILURE sent5GMM-DEREGISTERED, 5GMM-NULL or5GMM-IDLE mode entered | Delete the stored RAND and RES\* |
| T3517 | (a) 5s for case h) in subclause 5.6.1.1; or(b) 15s for cases other than h) in subclause 5.6.1.1NOTE 7NOTE 8 In WB-N1/CE mode, 61s | 5GMM-SERVICE-REQUEST-INITIATED | Transmission of SERVICE REQUEST message, or CONTROL PLANE SERVICE REQUEST message | (a) Indication from the lower layers that the UE has changed to S1 mode or E-UTRA connected to 5GCN for case h) in subclause 5.6.1.1; or(b) SERVICE ACCEPT message received, orSERVICE REJECT message received for cases other than h) in subclause 5.6.1.1 see subclause 5.6.1.4.2 | Abort the procedure |
| T3519 | 60sNOTE 7NOTE 8 In WB-N1/CE mode, 90s | 5GMM-REGISTERED-INITIATED5GMM-REGISTERED5GMM-DEREGISTERED-INITIATED5GMM-SERVICE-REQUEST-INITIATED (NOTE 6) | Transmission of IDENTITY RESPONSE message, REGISTRATION REQUEST message, or DEREGISTRATION REQUEST message with freshly generated SUCI | REGISTRATION ACCEPT message with new 5G-GUTI receivedCONFIGURATION UPDATE COMMAND message with new 5G-GUTI received DEREGISTRATION ACCEPT message | Delete stored SUCI |
| T3520 | 15sNOTE 7NOTE 8In WB-N1/CE mode, 33s | 5GMM-REGISTERED-INITIATED5GMM-REGISTERED5GMM-DEREGISTERED-INITIATED5GMM-SERVICE-REQUEST-INITIATED | Transmission of AUTHENTICATION FAILURE message with any of the 5GMM cause #20, #21, #26 or #71Transmission of AUTHENTICATION RESPONSE message with an EAP-response message after detection of an error as described in subclause 5.4.1.2.2.4 | AUTHENTICATION REQUEST message received or AUTHENTICATION REJECT message receivedorSECURITY MODE COMMAND message receivedwhen entering 5GMM-IDLE modeindication of transmission failure of AUTHENTICATION FAILURE message from lower layers | On first expiry during a 5G AKA based primary authentication and key agreement procedure, the UE should consider the network as false and follow item g of subclause 5.4.1.3.7, if the UE is not registered for emergency services.On first expiry during a 5G AKA based primary authentication and key agreement procedure, the UE will follow subclause 5.4.1.3.7 under "For items c, d, e and f:", if the UE is registered for emergency services.On first expiry during an EAP based primary authentication and key agreement procedure, the UE should consider the network as false and follow item e of subclause 5.4.1.2.4.5, if the UE is not registered for emergency services.On first expiry during an EAP based primary authentication and key agreement procedure, the UE will follow subclause 5.4.1.2.4.5 under "For item e:", if the UE is registered for emergency services |
| T3521 | 15sNOTE 7NOTE 8In WB-N1/CE mode, 45s | 5GMM-DEREGISTERED-INITIATED | Transmission of DEREGISTRATION REQUEST message when de-registration procedure is not due to a "switch off" | DEREGISTRATION ACCEPT message received | Retransmission of DEREGISTRATION REQUEST message |
| T3525 | Default 60sNOTE 3NOTE 7NOTE 8In WB-N1/CE mode, default 120s | 5GMM-REGISTERED.NORMAL-SERVICE | T3517 expires and service request attempt counter is greater than or equal to 5 | When entering state other than 5GMM-REGISTERED.NORMAL-SERVICE state,orUE camped on a new PLMN other than the PLMN on which timer started,orUser-plane resources established with the network | The UE may initiate service request procedure |
| T3540 | 10sNOTE 7 (applicable to case f) in subclause 5.3.1.3)NOTE 8In WB-N1/CE mode, 34s (applicable to case f) in subclause 5.3.1.3) | 5GMM-DEREGISTERED5GMM-REGISTERED | REGISTRATION REJECT message or DEREGISTRATION REQUEST message received with any of the 5GMM cause #3, #6, #7, #11, #12, #13, #15, #27, #31, #62, #72, #73, #74, #75 or #76SERVICE REJECT message received with any of the 5GMM cause #3, #6, #7, #11, #12, #13, #15, #27, #72, #73, #74, #75 or #76.REGISTRATION ACCEPT message received as described in subclause 5.3.1.3 case b)SERVICE ACCEPT message received as described in subclause 5.3.1.3 case f)AUTHENTICATION REJECT message received | N1 NAS signalling connection releasedPDU sessions have been set up | Release the NAS signalling connection for the cases a), b), f) and g) as described in subclause 5.3.1.3 |
| 5GMM-REGISTERED | CONFIGURATION UPDATE COMMAND message received as described in subclause 5.3.1.3 case e) and h) | N1 NAS signalling connection released | Release the NAS signalling connection for the case e) and perform a new registration procedure as described in subclause 5.5.1.3.2Release the NAS signalling connection for the case h) as described in subclause 5.3.1.3 |
| 5GMM-DEREGISTERED5GMM-DEREGISTERED.NORMAL-SERVICE5GMM-REGISTERED.NON-ALLOWED-SERVICE | REGISTRATION REJECT message received with the 5GMM cause #9 or #10SERVICE REJECT message received with the 5GMM cause #9, #10 or #28 | Release the NAS signalling connection for the cases c) and d) as described in subclause 5.3.1.3 and initiation of the registration procedure as specified in subclause 5.5.1.2.2 or 5.5.1.3.2 |
| Non-3GPP de-registration timer | Default 54 min.NOTE 1NOTE 2NOTE 4 | All 5GMM state over non-3GPP access except 5GMM-DEREGISTERED over non-3GPP access | Entering 5GMM-IDLE mode over non-3GPP access | N1 NAS signalling connection over non-3GPP access established or when entering state 5GMM-DEREGISTERED over non-3GPP access | Implicitly de-register the UE for non-3GPP access on 1st expiry |
| NOTE 1: The value of this timer is provided by the network operator during the registration procedure.NOTE 2: The default value of this timer is used if the network does not indicate a value in the REGISTRATION ACCEPT message and the UE does not have a stored value for this timer.NOTE 3: The value of this timer is UE implementation specific, with a minimum value of 60 seconds if not in NB-N1 mode and if not in WB-N1/CE mode.NOTE 4: If the T3346 value received in the mobility management messages is greater than the value of the non-3GPP de-registration timer, the UE sets the non-3GPP de-registration timer value to be 4 minutes greater than the value of timer T3346.NOTE 5: The conditions for which this applies are described in subclause 5.5.1.3.7.NOTE 6: The conditions for which this applies to the 5GMM-SERVICE-REQUEST-INITIATED state are described in subclause 5.4.1.3.7 case c) and case d).NOTE 7: In NB-N1 mode, the timer value shall be calculated as described in subclause 4.17.NOTE 8: In WB-N1 mode, if the UE supports CE mode B and operates in either CE mode A or CE mode B, then the timer value is as described in this table for the case of WB-N1/CE mode (see subclause 4.19). |

Table 10.2.2: Timers of 5GS mobility management – AMF side

| TIMER NUM. | TIMER VALUE | STATE | CAUSE OF START | NORMAL STOP | ON EXPIRY |
| --- | --- | --- | --- | --- | --- |
| T3513NOTE 7 NOTE 9 | NOTE 4 | 5GMM-REGISTERED | Paging procedure initiated | Paging procedure completed as specified in subclause 5.6.2.2.1 | Network dependent |
| T3522NOTE 6NOTE 8 | 6sIn WB-N1/CE mode, 24s | 5GMM-DEREGISTERED-INITIATED | Transmission of DEREGISTRATION REQUEST message | DEREGISTRATION ACCEPT message received | Retransmission of DEREGISTRATION REQUEST message |
| T3550NOTE 6NOTE 8 | 6sIn WB-N1/CE mode, 18s | 5GMM-COMMON-PROCEDURE-INITIATED | Transmission of REGISTRATION ACCEPT message as specified in subclause 5.5.1.2.4 and 5.5.1.3.4 | REGISTRATION COMPLETE message received | Retransmission of REGISTRATION ACCEPT message |
| T3555NOTE 6NOTE 8 | 6sIn WB-N1/CE mode, 24s | 5GMM-REGISTERED | Transmission of CONFIGURATION UPDATE COMMAND message with "acknowledgement requested" set in the Acknowldgement bit of the Configuration update indication IE | CONFIGURATION UPDATE COMPLETE message received | Retransmission of CONFIGURATION UPDATE COMMAND message |
| T3560NOTE 6NOTE 8 | 6sIn WB-N1/CE mode, 24s | 5GMM-COMMON-PROCEDURE-INITIATED | Transmission of AUTHENTICATION REQUEST messageTransmission of SECURITY MODE COMMAND message | AUTHENTICATION RESPONSE message receivedAUTHENTICATION FAILURE message receivedSECURITY MODE COMPLETE message receivedSECURITY MODE REJECT message received | Retransmission of AUTHENTICATION REQUEST message or SECURITY MODE COMMAND message |
| T3565NOTE 6NOTE 8 | 6sIn WB-N1/CE mode, 24s | 5GMM-REGISTERED | Transmission of NOTIFICATION message | SERVICE REQUEST message receivedNOTIFICATION RESPONSE message receivedREGISTRATION REQUESTMessage receivedDEREGISTRATION REQUEST message received NGAP UE context resume request message as specified in 3GPP TS 38.413 [31] received | Retransmission of NOTIFICATION message |
| T3570NOTE 6NOTE 8 | 6sIn WB-N1/CE mode, 24s | 5GMM-COMMON-PROCEDURE-INITIATED | Transmission of IDENTITY REQUEST message | IDENTITY RESPONSE message received | Retransmission of IDENTITY REQUEST message |
| T3575 | 15s | 5GMM-REGISTERED | Transmission of NETWORK SLICE-SPECIFIC AUTHENTICATION COMMAND message | NETWORK SLICE-SPECIFIC AUTHENTICATION COMPLETE message received | Retransmission of NETWORK SLICE-SPECIFIC AUTHENTICATION COMMAND message |
| Active timer | NOTE 10 | All except 5GMM-DEREGISTERED | Entering 5GMM-IDLE mode after indicating MICO mode activation to the UE with an active timer value. | N1 NAS signallingconnection established | Activate MICO mode for the UE. |
| Implicit de-registration timer | NOTE 2 | All except 5GMM-DEREGISTERED | The mobile reachable timer expires while the network is in 5GMM-IDLE modeEntering 5GMM-IDLE mode over 3GPP access if the MICO mode is activated and strictly periodic monitoring timer is not runningThe strictly periodic monitoring timer expires while the network is in 5GMM-IDLE mode | N1 NAS signalling connection established | Implicitly de-register the UE on 1st expiry |
| Mobile reachable timer | NOTE 1  | All except 5GMM-DEREGISTERED | Entering 5GMM-IDLE mode | N1 NAS signalling connection established | Network dependent, but typically paging is halted on 1st expiry, and start implicit de-registration timer, if the UE is not registered for emergency services.Implicitly de-register the UE which is registered for emergency services |
| Non-3GPP implicit de-registration timer | NOTE 3 | All except 5GMM-DEREGISTERED | Entering 5GMM-IDLE mode over non-3GPP access | N1 NAS signalling connection over non-3GPP access established | Implicitly de-register the UE for non-3GPP access on 1s expiry |
| Strictly periodic monitoring timer | NOTE 5 | All except 5GMM-DEREGISTERED | At the successful completion of registration update procedure if strictly periodic registration timer indication is supported as specified in subclause 5.3.7. | Entering 5GMM-DEREGISTERED. | In 5GMM-IDLE mode, start implicit de-registration timer as specified in subclause 5.3.7.In 5GMM-CONNECTED mode, Strictly periodic monitoring timer is started again as specified in subclause 5.3.7. |
| NOTE 1: The default value of this timer is 4 minutes greater than the value of timer T3512. If the UE is registered for emergency services, the value of this timer is set equal to the value of timer T3512. If the T3346 value provided in the mobility management messages is greater than the value of the timer T3512, the AMF sets the mobile reachable timer and the implicit de-registration timer such that the sum of the timer values is greater than the value of timer T3346.NOTE 2: The value of this timer is network dependent. If MICO is activated, the default value of this timer is 4 minutes greater than the value of timer T3512.NOTE 3: The value of this timer is network dependent. The default value of this timer is 4 minutes greater than the non-3GPP de-registration timer. If the T3346 value provided in the mobility management messages is greater than the value of the non-3GPP de-registration timer, the AMF sets the non-3GPP implicit de-registration timer value to be 8 minutes greater than the value of timer T3346.NOTE 4: The value of this timer is network dependent.NOTE 5: The value of this timer is the same as the value of timer T3512.NOTE 6: In NB-N1 mode, the timer value shall be calculated as described in subclause 4.17.NOTE 7: In NB-N1 mode, the timer value shall be calculated by using an NAS timer value which is network dependent.NOTE 8: In WB-N1 mode, if the UE supports CE mode B and operates in either CE mode A or CE mode B, then the timer value is as described in this table for the case of WB-N1/CE mode (see subclause 4.19).NOTE 9: In WB-N1 mode, if the UE supports CE mode B, then the timer value shall be calculated by using an NAS timer value which value is network dependent.NOTE 10: If the AMF includes timer T3324 in the REGISTRATION ACCEPT message and if the UE is not registered for emergency services, the value of this timer is equal to the value of timer T3324. |