**3GPP TSG-CT WG1 Meeting #123-eC1-202802**

**Electronic meeting, 16-24 April 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **24.501** | **CR** | **2182** | **rev** | **1** | **Current version:** | **16.4.1** |  |
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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 | **x** |

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| ***Title:*** | Single-registration mode without N26 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | C1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | 5GProtoc16 | | | | |  | ***Date:*** | | | 2020-03-26 |
|  |  | | | |  | |  | | |  |
| ***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 can be 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)* | |
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| ***Reason for change:*** | | The UE supporting single-registration mode can work in single-registration mode in following two cases:   1. The network supports N26 interface; and 2. The network does not support N26 interface.   Some interworking handling is only applicable or only needed in case of single-registration mode in a network supporting N26 interface, i.e. is not applicable or not needed in case of single-registration mode in a network without N26 interface:   1. Deriving of mapped 5GS NAS security context or mapped EPS security context: without N26 interface, both the UE and the AMF cannot derive the mapped 5GS NAS security context and mapped EPS security context;   Note that TS 24.501 has already defined below term but it was not used consistently in the spec:  “***UE operating in single-registration mode in a network supporting N26 interface****: a UE, supporting both N1 mode and S1 mode. During the last attach, tracking area update (see 3GPP TS 24.301 [15]) or registration procedures, the UE has received either a 5GS network feature support IE with IWK N26 bit set to "interworking without N26 interface not supported" or an EPS network feature support IE with IWK N26 bit set to "interworking without N26 interface not supported".*” | | | | | | | | |
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| ***Summary of change:*** | | It proposes to correct that some interworking handling is only applicable or only needed in case of single-registration mode in a network supporting N26 interface.  It proposes to use the defined term “***UE operating in single-registration mode in a network supporting N26 interface***” consistently through the spec. | | | | | | | | |
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| ***Consequences if not approved:*** | | It does not make any sense for some interworking handling in case of single-registration mode in a network does not supporting N26 interface. | | | | | | | | |
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| ***Clauses affected:*** | | 4.4.2.1, 4.4.2.2, 4.4.2.4, 5.5.1.3.7, 6.2.11, 6.4.2.1, 6.4.2.2, 6.4.2.4.2, 8.3.7.2, 8.3.7.4, 8.3.7.5, 8.3.7.6 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

\* \* \* First Change \* \* \* \*

#### 4.4.2.1 General

The security parameters for authentication, integrity protection and ciphering are tied together in a 5G NAS security context and identified by a key set identifier (ngKSI). The relationship between the security parameters is defined in 3GPP TS 33.501 [24].

Before security can be activated, the AMF and the UE need to establish a 5G NAS security context. Usually, the 5G NAS security context is created as the result of a primary authentication and key agreement procedure between the AMF and the UE. A new 5G NAS security context may also be created during an N1 mode to N1 mode handover. Alternatively, during inter-system change from S1 mode to N1 mode, the AMF not supporting interworking without N26 and the UE operating in single-registration mode may derive a mapped 5G NAS security context from an EPS security context that has been established while the UE was in S1 mode.

The 5G NAS security context is taken into use by the UE and the AMF, when the AMF initiates a security mode control procedure, during an N1 mode to N1 mode handover, or during the inter-system change procedure from S1 mode to N1 mode. The 5G NAS security context which has been taken into use by the network most recently is called current 5G NAS security context. This current 5G NAS security context can be of type native or mapped, i.e. originating from a native 5G NAS security context or mapped 5G NAS security context.

The key set identifier ngKSI is assigned by the AMF either during the primary authentication and key agreement procedure or, for the mapped 5G NAS security context, during the inter-system change. The ngKSI consists of a value and a type of security context parameter indicating whether a 5G NAS security context is a native 5G NAS security context or a mapped 5G NAS security context. When the 5G NAS security context is a native 5G NAS security context, the ngKSI has the value of KSIAMF, and when the current 5G NAS security context is of type mapped, the ngKSI has the value of KSIASME.

The 5G NAS security context which is indicated by an ngKSI can be taken into use to establish the secure exchange of NAS messages when a new N1 NAS signalling connection is established without executing a new primary authentication and key agreement procedure (see subclause 5.4.1) or when the AMF initiates a security mode control procedure. For this purpose, the initial NAS messages (i.e. REGISTRATION REQUEST, DEREGISTRATION REQUEST, SERVICE REQUEST and CONTROL PLANE SERVICE REQUEST) and the SECURITY MODE COMMAND message contain an ngKSI in the NAS key set identifier IE indicating the current 5G NAS security context used to integrity protect the NAS message.

In the present document, when the UE is required to delete an ngKSI, the UE shall set the ngKSI to the value "no key is available" and consider also the associated keys KAMF or K'AMF, 5G NAS ciphering key and 5G NAS integrity key invalid (i.e. the 5G NAS security context associated with the ngKSI as no longer valid).

NOTE: In some specifications the term ciphering key sequence number might be used instead of the term key set identifier (KSI).

As described in subclause 4.8 in order to interwork with E-UTRAN connected to EPC, the UE supporting both S1 mode and N1 mode can operate in either single-registration mode or dual-registration mode. A UE operating in dual-registration mode shall independently maintain and use both EPS security context (see 3GPP TS 24.301 [15]) and 5G NAS security context. When the UE operating in dual-registration mode performs an EPS attach procedure, it shall take into use an EPS security context and follow the handling of this security context as specified in 3GPP TS 24.301 [15]. However, when the UE operating in dual-registration mode performs an initial registration procedure, it shall take into use a 5G NAS security context and follow the handling of this security context as described in the present specification.

The UE and the AMF need to be able to maintain two 5G NAS security contexts simultaneously, i.e. a current 5G NAS security context and a non-current 5G NAS security context, since:

a) after a 5G re-authentication, the UE and the AMF can have both a current 5G NAS security context and a non-current 5G NAS security context which has not yet been taken into use (i.e. a partial native 5G NAS security context); and

b) after an inter-system change from S1 mode to N1 mode, the UE and the AMF can have both a mapped 5G NAS security context, which is the current 5G NAS security context, and a non-current native 5G NAS security context that was created during a previous access in N1 mode.

The number of 5G NAS security contexts that need to be maintained simultaneously by the UE and the AMF is limited by the following requirements:

a) after a successful 5G (re-)authentication, which creates a new partial native 5G NAS security context, the AMF and the UE shall delete the non-current 5G NAS security context, if any;

b) when a partial native 5G NAS security context is taken into use through a security mode control procedure, the AMF and the UE shall delete the previously current 5G NAS security context;

c) when the AMF and the UE create a 5G NAS security context using "null integrity protection algorithm" and "null ciphering algorithm" during an initial registration procedure for emergency services, or a registration procedure for mobility and periodic registration update for a UE that has an emergency PDU session (see subclause 5.4.2.2), the AMF and the UE shall delete the previous current 5G NAS security context;

d) when a new mapped 5G NAS security context or 5G NAS security context created using "null integrity protection algorithm" and "null ciphering algorithm" is taken into use during the inter-system change from S1 mode to N1 mode, the AMF and the UE shall not delete the previously current native 5G NAS security context, if any. Instead, the previously current native 5G NAS security context shall become a non-current native 5G NAS security context, and the AMF and the UE shall delete any partial native 5G NAS security context;

If no previously current native 5G NAS security context exists, the AMF and the UE shall not delete the partial native 5G NAS security context, if any;

e) when the AMF and the UE derive a new mapped 5G NAS security context during inter-system change from S1 mode to N1 mode, the AMF and the UE shall delete any existing current mapped 5G NAS security context;

f) when a non-current full native 5G NAS security context is taken into use by a security mode control procedure, then the AMF and the UE shall delete the previously current mapped 5G NAS security context;

g) when the UE or the AMF moves from 5GMM-REGISTERED to 5GMM-DEREGISTERED state, if the current 5G NAS security context is a mapped 5G NAS security context and a non-current full native 5G NAS security context exists, then the non-current 5G NAS security context shall become the current 5G NAS security context. Furthermore, the UE and the AMF shall delete any mapped 5G NAS security context or partial native 5G NAS security context.

h) when the UE operating in single-registration mode in a network supporting N26 interface performs an inter-system change from N1 mode to S1 mode:

1) if the UE has a mapped 5G NAS security context and the inter-system change is performed in:

i) 5GMM-IDLE mode, the UE shall delete the mapped 5G NAS security context after the successful completion of the tracking area update procedure (see 3GPP TS 24.301 [15]); or

ii) 5GMM-CONNECTED mode, the UE shall delete the mapped 5G NAS security context after the completion of the inter-system change; and

i) when the UE operating in single-registration mode in a network supporting N26 interface performs an inter-system change from S1 mode to N1 mode in 5GMM-IDLE mode, if the UE has a non-current full native 5G NAS security context, then the UE shall make the non-current full native 5G NAS security context as the current native 5G NAS security context. The UE shall delete the mapped 5G NAS security context, if any.

The UE shall mark the 5G NAS security context on the USIM or in the non-volatile memory as invalid when the UE initiates an initial registration procedure as described in subclause 5.5.1.2 or when the UE leaves state 5GMM-DEREGISTERED for any other state except 5GMM-NULL.

The UE shall store the current native 5G NAS security context as specified in annex C and mark it as valid only when the UE enters state 5GMM-DEREGISTERED from any other state except 5GMM-NULL or when the UE aborts the initial registration procedure without having left 5GMM-DEREGISTERED.

\* \* \* Next Change \* \* \* \*

#### 4.4.2.2 Establishment of a mapped 5G NAS security context during inter-system change from S1 mode to N1 mode in 5GMM-CONNECTED mode

In order for the UE operating in single-registration mode in a network supporting N26 interface to derive a mapped 5G NAS security context for an inter-system change from S1 mode to N1 mode in 5GMM-CONNECTED mode, the AMF shall construct a mapped 5G NAS security context from the EPS security context received from the source MME as indicated in 3GPP TS 33.501 [24]. The AMF shall select the 5G NAS security algorithms and derive the 5G NAS keys (i.e. KNASenc and KNASint). The AMF shall define an ngKSI for the newly derived K'AMF key such that the value field is taken from the eKSI of the KASME key and the type field is set to indicate a mapped security context and associate this ngKSI with the newly created mapped 5G NAS security context. The AMF shall then include the message authentication code, selected NAS algorithms, NCC, NAS sequence number, replayed UE security capabilities and generated ngKSI in the S1 mode to N1 mode NAS transparent container IE (see subclause 9.11.2.9).

When the UE operating in single-registration mode in a network supporting N26 interface receives the command to perform inter-system change to N1 mode in 5GMM-CONNECTED mode, the UE shall derive a mapped K'AMF, as indicated in 3GPP TS 33.501 [24], using the KASME from the EPS security context. Furthermore, the UE shall also derive the 5G NAS keys from the mapped K'AMF using the selected NAS algorithm identifiers included in the S1 mode to N1 mode NAS transparent container IE and associate this mapped 5G NAS security context with the ngKSI value received. The UE shall then verify the received NAS MAC. In case the received NAS MAC is not verified successfully (see subclause 4.4.3.3) the UE shall discard the content of the received S1 mode to N1 mode NAS transparent container IE and inform the lower layers that the received S1 mode to N1 mode NAS transparent container is invalid.

When the UE operating in single-registration mode in a network supporting N26 interface has a PDN connection for emergency bearer services and has no current EPS security context, the AMF shall set 5G-IA0 and 5G-EA0 as the selected 5G NAS security algorithms in the S1 mode to N1 mode NAS transparent container IE. The AMF shall create a locally generated K'AMF. The AMF shall set the ngKSI value of the associated security context to "000" and the type of security context flag to "mapped security context" in the S1 mode to N1 mode NAS transparent container IE.

When the UE operating in single-registration mode in a network supporting N26 interface receives the command to perform inter-system change to N1 mode in 5GMM-CONNECTED mode (see 3GPP TS 38.331 [30]) and has a PDN connection for emergency bearer services, if 5G-IA0 and 5G-EA0 as the selected 5G NAS security algorithms are included in the S1 mode to N1 mode NAS transparent container IE, the UE shall create a locally generated K'AMF. Furthermore, the UE shall set the ngKSI value of the associated security context to the KSI value received.

After the new mapped 5G NAS security context is taken into use for the 3GPP access following a successful inter system change from S1 mode to N1 mode in 5GMM-CONNECTED mode and the UE is registered with the same PLMN over the 3GPP access and non-3GPP access:

a) if a native 5G NAS security context is used on the non-3GPP access and:

1) the UE is in 5GMM-IDLE mode over the non-3GPP access, then the AMF and the UE shall activate and take into use the 5G NAS security context over the non-3GPP access that is used on the 3GPP access as described in 3GPP TS 33.501 [24] after the AMF sends or the UE receives the REGISTRATION ACCEPT message respectively. If the 5G NAS security context in use on both accesses is a mapped context, the UE and AMF shall keep the native 5G NAS security context over the non-3GPP access and make it a non-current native 5G NAS security context. The non-current native 5G NAS security context may be re-activated later using the security mode control procedure; or

2) the UE is in 5GMM-CONNECTED mode over the non-3GPP access, in order to activate the native 5G NAS security context over the 3GPP access that is active on the non-3GPP access the AMF shall send the SECURITY MODE COMMAND message over the 3GPP access as described in 3GPP TS 33.501 [24]. The SECURITY MODE COMMAND message shall include the same ngKSI to identify the naitive 5G NAS security context that is used on the non-3GPP access; or

b) if a mapped 5G NAS security context is used on the non-3GPP access and:

1) the UE is in 5GMM-IDLE mode over the non-3GPP access, the AMF and the UE shall activate and take into use the new mapped 5G NAS security context active on the 3GPP access for the non-3GPP access as described in 3GPP TS 33.501 [24] after the AMF sends or the UE receives the REGISTRATION ACCEPT message respectively; or

2) the UE is in 5GMM-CONNECTED mode over the non-3GPP access, in order to activate the same mapped 5G NAS security context over a target access that is used on the other access the AMF shall send the SECURITY MODE COMMAND message over one-access as described in 3GPP TS 33.501 [24]. The SECURITY MODE COMMAND message shall include the same ngKSI to identify the mapped 5G NAS security context that is used over the other access.

If the inter-system change from S1 mode to N1 mode in 5GMM-CONNECTED mode is not completed successfully, the AMF and the UE operating in single-registration mode in a network supporting N26 interface shall delete the new mapped 5G NAS security context.

\* \* \* Next Change \* \* \* \*

#### 4.4.2.4 Establishment of an EPS security context during inter-system change from N1 mode to S1 mode in 5GMM-CONNECTED mode

In order for the UE operating in single-registration mode in a network supporting N26 interface to derive a mapped EPS security context for an inter-system change from N1 mode to S1 mode in 5GMM-CONNECTED mode, the AMF shall prepare a mapped EPS security context for the target MME as indicated in 3GPP TS 33.501 [24].

The AMF shall derive a K'ASME using the KAMF key and the downlink NAS COUNT of the current 5G NAS security context, include the corresponding NAS sequence number in the N1 mode to S1 mode NAS transparent container IE (see subclause 9.11.2.7) and then increments its stored downlink NAS COUNT value by one. The AMF shall select the NAS algorithms identifiers to be used in the target MME after the inter-system change from N1 mode to S1 mode in 5GMM-CONNECTED mode, for encryption and integrity protection. The uplink and downlink NAS COUNT associated with the newly derived K'ASME key are set to the uplink and downlink NAS COUNT value of the current 5G NAS security context respectively. The eKSI for the newly derived K'ASME key shall be defined such as the value field is taken from the ngKSI and the type field is set to indicate a mapped security context.

When the UE operating in single-registration mode in a network supporting N26 interface receives a command to perform inter-system change from N1 mode to S1 mode in 5GMM-CONNECTED mode, the UE shall derive the mapped EPS security context, i.e. derive K'ASME from KAMF using a downlink NAS COUNT based on the NAS sequence number received in the N1 mode to S1 mode NAS transparent container IE (see subclause 9.11.2.7) as described in 3GPP TS 33.501 [24]. The UE shall set the uplink and downlink NAS COUNT values associated with the newly derived K'ASME key to the uplink and downlink NAS COUNT values of the current 5G NAS security context respectively. The eKSI for the newly derived K'ASME key is defined such that the value field is taken from the ngKSI and the type field is set to indicate a mapped security context. The UE shall also derive the NAS keys as specified in 3GPP TS 33.401 [23A] using the EPS NAS security algorithms identifiers that are stored in the UE's 5G NAS security context.

If the received N1 mode to S1 mode NAS transparent container IE does not have a valid NAS COUNT (see subclause 4.4.3.2) the UE shall discard the content of the received N1 mode to S1 mode NAS transparent container IE and inform the lower layers that the received N1 mode to S1 mode NAS transparent container is invalid.

If the inter-system change from N1 mode to S1 mode in 5GMM-CONNECTED mode is not completed successfully, the AMF and the UE shall delete the new mapped EPS security context.

\* \* \* Next Change \* \* \* \*

##### 5.5.1.3.7 Abnormal cases in the UE

The following abnormal cases can be identified:

a) Timer T3346 is running.

The UE shall not start the registration procedure for mobility and periodic registration update unless:

1) the UE is in 5GMM-CONNECTED mode;

2) the UE received a paging;

3) the UE receives a NOTIFICATION message over non-3GPP access when the UE is in 5GMM-CONNECTED mode over non-3GPP access and in 5GMM-IDLE mode over 3GPP access;

4) the UE is a UE configured for high priority access in selected PLMN;

5) the UE has an emergency PDU session established or is establishing an emergency PDU session;

6) the UE receives a request from the upper layers to perform emergency service fallback;

7) the UE receives the CONFIGURATION UPDATE COMMAND message as specified in subclause 5.4.4.3; or

8) the UE in NB-N1 mode is requested by the upper layer to transmit user data related to an exceptional event and:

- the UE is allowed to use exception data reporting (see the ExceptionDataReportingAllowed leaf of the NAS configuration MO in 3GPP TS 24.368 [17] or the USIM file EFNASCONFIG in 3GPP TS 31.102 [22]); and

- timer T3346 was not started when N1 NAS signalling connection was established with RRC establishment cause set to "mo-ExceptionData".

The UE stays in the current serving cell and applies the normal cell reselection process.

NOTE 1: It is considered an abnormal case if the UE needs to initiate a registration procedure for mobility and periodic registration update while timer T3346 is running independent on whether timer T3346 was started due to an abnormal case or a non-successful case.

If the registration procedure for mobility and periodic registration update was initiated for an MO MMTEL voice call (i.e. access category 4), for an MO IMS registration related signalling (i.e. access category 9), or for NAS signalling connection recovery during an ongoing MO MMTEL voice call (i.e. access category 4) or during an ongoing MO IMS registration related signalling (i.e. access category 9), then a notification that the procedure was not initiated due to network congestion shall be provided to upper layers.

b) The lower layers indicate that the access attempt is barred.

The UE shall not start the registration procedure for mobility and periodic registration update. The UE stays in the current serving cell and applies the normal cell reselection process. Receipt of the access barred indication shall not trigger the selection of a different core network type (EPC or 5GCN).

The registration procedure for mobility and periodic registration update is started, if still needed, when the lower layers indicate that the barring is alleviated for the access category with which the access attempt was associated.

ba) The lower layers indicate that access barring is applicable for all access categories except categories 0 and 2 and the access category with which the access attempt was associated is other than 0 and 2.

If the REGISTRATION REQUEST message has not been sent, the UE shall proceed as specified for case b. If the REGISTRATION REQUEST message has been sent, the UE shall proceed as specified for case e and, additionally, the registration procedure for mobility and periodic registration update is started, if still needed, when the lower layers indicate that the barring is alleviated for the access category with which the access attempt was associated. For additional UE requirements for both cases see subclause 4.5.5.

c) T3510 timeout.

The UE shall abort the registration update procedure and the NAS signalling connection, if any, shall be released locally. The UE shall proceed as described below.

d) REGISTRATION REJECT message, other 5GMM cause values than those treated in subclause 5.5.1.3.5, and cases of 5GMM cause values #11, #22, #31, #72, #73, #74, #75, #76 and #77, if considered as abnormal cases according to subclause 5.5.1.3.5.

Upon reception of the 5GMM causes #95, #96, #97, #99 and #111 the UE should set the registration attempt counter to 5.

The UE shall proceed as described below.

e) Lower layer failure, release of the NAS signalling connection received from lower layers or the lower layers indicate that the RRC connection has been suspended without a cell change before the REGISTRATION ACCEPT or REGISTRATION REJECT message is received.

The UE shall abort the registration procedure and proceed as described below.

f) Change of cell into a new tracking area.

If a cell change into a new tracking area occurs before the registration procedure for mobility and periodic registration update is completed, the registration procedure for mobility and periodic registration update shall be aborted and re-initiated immediately. The UE shall set the 5GS update status to 5U2 NOT UPDATED.

g) Registration procedure for mobility and periodic registration update and de-registration procedure collision.

If the UE receives a DEREGISTRATION REQUEST message without 5GMM cause value #11, #12, #13 or #15 before the registration procedure for mobility and periodic registration update has been completed, the registration procedure for mobility and periodic registration update shall be aborted and the de-registration procedure shall be progressed.

If the UE receives a DEREGISTRATION REQUEST message with 5GMM cause value #11, #12, #13 or #15 before the registration procedure for mobility and periodic registration update has been completed, the registration procedure for mobility and periodic registration update shall be progressed and the de-registration procedure shall be aborted.

NOTE 2: The registration procedure for mobility and periodic registration update shall be aborted only if the DEREGISTRATION REQUEST message indicates in the access type that the access in which the registration procedure for mobility and periodic registration update was attempted shall be de-registered. Otherwise both the procedures shall be progressed.

h) Void

i) Transmission failure of REGISTRATION REQUEST message indication from the lower layers or the lower layers indicate that the RRC connection has been suspended with a cell change.

The registration procedure for mobility and periodic registration update shall be aborted and re-initiated immediately. The UE shall set the 5GS update status to 5U2 NOT UPDATED.

j) Transmission failure of REGISTRATION COMPLETE message indication with TAI change from lower layers.

If the current TAI is not in the TAI list, the registration procedure for mobility and periodic registration update shall be aborted and re-initiated immediately. The UE shall set the 5GS update status to 5U2 NOT UPDATED.

If the current TAI is still part of the TAI list, it is up to the UE implementation how to re-run the ongoing procedure.

k) Transmission failure of REGISTRATION COMPLETE message indication without TAI change from lower layers.

It is up to the UE implementation how to re-run the ongoing procedure.

l) UE-initiated de-registration required.

De-registration due to removal of USIM or due to switch off:

The registration procedure for mobility and periodic registration update shall be aborted, and the UE initiated de-registration procedure shall be performed.

De-registration not due to removal of USIM and not due to switch off:

the UE initiated de-registration procedure shall be initiated after successful completion of the registration procedure for mobility and periodic registration update.

m) Timer T3447 is running

The UE shall not start any mobility and periodic registration update procedure with Uplink data status IE or Follow-on request indicator set to "Follow-on request pending" unless:

- the UE received a paging;

- the UE is a UE configured for high priority access in selected PLMN;

- the UE has an emergency PDU session established or is establishing an emergency PDU session; or

- the UE receives a request from the upper layers to perform emergency service fallback;

The UE stays in the current serving cell and applies the normal cell reselection process. The mobility and periodic registration update procedure is started, if still necessary, when timer T3447 expires.

n) Timer T3448 is running

The UE in 5GMM-IDLE mode shall not start any mobility and periodic registration update procedure with Follow-on request indicator set to "Follow-on request pending" unless:

1) the UE is a UE configured for high priority access in selected PLMN;

2) the UE which is only using 5GS services with control plane CIoT 5GS optimization received a paging request; or

3) the UE in NB-N1 mode is requested by the upper layer to transmit user data related to an exceptional event and the UE is allowed to use exception data reporting (see the ExceptionDataReportingAllowed leaf of the NAS configuration MO in 3GPP TS 24.368 [17] or the USIM file EFNASCONFIG in 3GPP TS 31.102 [22]).

The UE stays in the current serving cell and applies the normal cell reselection process. The mobility and periodic registration update procedure is started, if still necessary, when timer T3448 expires.

For the cases c, d and e the UE shall proceed as follows:

Timer T3510 shall be stopped if still running.

The registration attempt counter shall be incremented, unless it was already set to 5.

If the registration attempt counter is less than 5:

- if the TAI of the current serving cell is not included in the TAI list or the 5GS update status is different to 5U1 UPDATED or if the registration procedure was triggered due to cases c, g, n, v in subclause 5.5.1.3.2, the UE shall start timer T3511, shall set the 5GS update status to 5U2 NOT UPDATED and change to state 5GMM-REGISTERED.ATTEMPTING-REGISTRATION-UPDATE. When timer T3511 expires, the registration update procedure is triggered again.

- if the TAI of the current serving cell is included in the TAI list, the 5GS update status is equal to 5U1 UPDATED, and the UE is not performing the registration procedure after an inter-system change from S1 mode to N1 mode, the UE shall keep the 5GS update status to 5U1 UPDATED and enter state 5GMM-REGISTERED.NORMAL-SERVICE. The UE shall start timer T3511. If in addition the REGISTRATION REQUEST message did not include the MICO indication IE or the Extended DRX IE, and:

- the REGISTRATION REQUEST message indicated "periodic registration updating";

- the registration procedure was initiated to recover the NAS signalling connection due to "RRC Connection failure" from the lower layers; or

- the registration procedure was initiated by the UE in 5GMM-CONNECTED mode with RRC inactive indication entering a cell in the current registration area belonging to an equivalent PLMN of the registered PLMN and not belonging to the registered PLMN,

and none of the other reasons for initiating the registration updating procedure listed in subclause 5.5.1.3.2 was applicable, the timer T3511 may be stopped when the UE enters 5GMM-CONNECTED mode.

- if the TAI of the current serving cell is included in the TAI list, the 5GS update status is equal to 5U1 UPDATED and the UE is performing the registration procedure after an inter-system change from S1 mode to N1 mode, the UE shall change the 5GS update status to 5U2 NOT UPDATED and enter state 5GMM-REGISTERED.ATTEMPTING-REGISTRATION-UPDATE. The UE shall start timer T3511.

- If the procedure is performed via 3GPP access and the UE is operating in single-registration mode, the UE shall in addition handle the EPS update status as specified in 3GPP TS 24.301 [15] for the abnormal cases when a normal or periodic tracking area updating procedure fails and the tracking area attempt counter is less than 5 and the EPS update status is different from EU1 UPDATED.

If the registration attempt counter is equal to 5

- the UE shall start timer T3502, shall set the 5GS update status to 5U2 NOT UPDATED.

- the UE shall delete the list of equivalent PLMNs (if any) and shall change to state 5GMM-REGISTERED.ATTEMPTING-REGISTRATION-UPDATE or optionally to 5GMM-REGISTERED.PLMN-SEARCH in order to perform a PLMN selection or SNPN selection according to 3GPP TS 23.122 [5].

- if the procedure is performed via 3GPP access and the UE is operating in single-registration mode:

- the UE shall in addition handle the EPS update status as specified in 3GPP TS 24.301 [15] for the abnormal cases when a normal or periodic tracking area updating procedure fails and the tracking area attempt counter is equal to 5; and

- if the UE does not change to state 5GMM-REGISTERED.PLMN-SEARCH, the UE shall attempt to select E-UTRAN radio access technology. The UE may disable the N1 mode capability as specified in subclause 4.9.

\* \* \* Next Change \* \* \* \*

### 6.2.11 Multi-homed IPv6 PDU session

The UE supporting IPv6 may support multi-homed IPv6 PDU session.

If the UE supports the multi-homed IPv6 PDU session:

a) the UE shall support acting as a type C host as specified in IETF RFC 4191 [36]; and

b) the UE indicates support of the multi-homed IPv6 PDU session:

1) during the UE-requested PDU session establishment of a PDU session of "IPv6" or "IPv4v6" PDU session type; and

2) during the UE-requested PDU session modification performed after the first inter-system change from S1 mode to N1 mode, for a PDU session associated with a PDN connection established when in S1 mode, if the UE is a UE operating in single-registration mode in a network supporting N26 interface, and the PDU session is of "IPv6" or "IPv4v6" PDU session type.

\* \* \* Next Change \* \* \* \*

#### 6.4.2.1 General

The purpose of the UE-requested PDU session modification procedure is:

a) to enable the UE to request modification of a PDU session;

b) to indicate a change of 3GPP PS data off UE status for a PDU session;

c) to revoke the previously indicated support for reflective QoS;

d) to request specific QoS handling and segregation of service data flows;

e) to indicate to the network the relevant 5GSM parameters and capabilities (e.g. the UE's 5GSM capabilities, whether the UE supports more than 16 packet filters, the maximum data rate per UE for user-plane integrity protection supported by the UE for uplink, the maximum data rate per UE for user-plane integrity protection supported by the UE for downlink and whether the UE requests the PDU session to be an always-on PDU session in the 5GS) for a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is a UE operating in single-registration mode in a network supporting N26 interface;

f) to delete one or more mapped EPS bearer contexts;

g) to convey a port management information container; or

h) to re-negotiate header compression configuration associated to a PDU session using control plane CIoT 5GS optimization.

When the UE-requested PDU session modification procedure is used to indicate a change of 3GPP PS data off UE status for a PDU session (see subclause 6.2.10), the UE shall initiate the UE-requested PDU session modification procedure even if the UE is outside the LADN service area or the timer T3396, T3584, T3585 or the back-off timer is running or is deactivated.

If the UE needs to revoke the previously indicated support for reflective QoS for a PDU session and timer T3396, T3584, T3585 or the back-off timer is running or is deactivated, the UE shall not initiate the UE-requested PDU session modification procedure and shall instead initiate the UE-requested PDU session release procedure.

If the UE needs to initiate the UE-requested PDU session modification procedure to indicate to the network the relevant 5GSM parameters and capabilities (e.g. the UE's 5GSM capabilities, whether the UE supports more than 16 packet filters, the maximum data rate per UE for user-plane integrity protection supported by the UE for uplink, the maximum data rate per UE for user-plane integrity protection supported by the UE for downlink and whether the UE requests the PDU session to be an always-on PDU session in the 5GS) for a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, the UE is a UE operating in single-registration mode in a network supporting N26 interface and timer T3396, T3584, T3585 or the back-off timer is running, the UE shall initiate the UE-requested PDU session modification procedure after expiry of timer T3396, T3584 or T3585 or after expiry of the back-off timer.

\* \* \* Next Change \* \* \* \*

#### 6.4.2.2 UE-requested PDU session modification procedure initiation

In order to initiate the UE-requested PDU session modification procedure, the UE shall create a PDU SESSION MODIFICATION REQUEST message.

The UE shall allocate a PTI value currently not used and shall set the PTI IE of the PDU SESSION MODIFICATION REQUEST message to the allocated PTI value.

The UE shall not perform the UE-requested PDU session modification procedure for an emergency PDU session except for the error cases described in subclause 6.4.1.3 and subclause 6.3.2.3.

The UE shall not perform the UE-requested PDU session modification procedure for a PDU session for LADN when the UE is located outside the LADN service area except for indicating a change of 3GPP PS data off UE status.

If the UE requests a specific QoS handling, the UE shall include the requested QoS rules IE indicating requested QoS rules or the requested QoS flow descriptions IE indicating requested QoS flow descriptions or both for the specific QoS handling. The QoS rules IE includes the packet filters which describe the service data flows requested by the UE. The specific QoS parameters requested by the UE is specified in the QoS flow descriptions IE. If the UE requests the network to bind specific service data flows to a dedicated QoS flow, the UE shall create a new QoS rule by setting the rule operation code to "Create new QoS rule" and shall set the segregation bit to "Segregation requested" for the corresponding QoS rule in the QoS rules IE. The UE shall set the QRI values to "no QoS rule identifier assigned" in the requested QoS rules IE, if the QoS rules are newly created; otherwise, the UE shall set the QRI values to those of the existing QoS rules for which the specific QoS handling applies. The UE shall set the QFI values to "no QoS flow identifier assigned" in the requested QoS flow descriptions IE, if the QoS flow descriptions are newly created; otherwise, the UE shall set the QFI values to the QFIs of the existing QoS flow descriptions for which the specific QoS handling applies. The UE shall not request to create more than one QoS flow in a UE-requested PDU session modification procedure. If the SMF receives a PDU SESSION MODIFICATION REQUEST message with a Requested QoS rules IE containing more than one QoS rule with the rule operation code set to "Create new QoS rule", the SMF shall assign the same QFI to all the QoS rules which are created.

For a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is a UE operating in single-registration mode in a network supporting N26 interface, the PDU session is of "IPv4", "IPv6", "IPv4v6", or "Ethernet" PDU session type, and:

a) the UE is performing the PDU session modification procedure to indicate the support of reflective QoS, the UE shall set the RQoS bit to "Reflective QoS supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message; or

b) the UE is performing the PDU session modification procedure to indicate that reflective QoS is not supported, the UE shall set the RQoS bit to "Reflective QoS not supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message.

If the UE is performing the PDU session modification procedure to revoke the previously indicated support of reflective QoS, the UE shall set the RQoS bit to "Reflective QoS not supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message. The UE shall not indicate support for reflective QoS for this PDU Session for the remaining lifetime of the PDU Session.

NOTE: The determination to revoke the usage of reflective QoS by the UE for a PDU session is implementation dependent.

For a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is a UE operating in single-registration mode in a network supporting N26 interface, the PDU session is of "IPv6" or "IPv4v6" PDU session type, and:

a) the UE is performing the PDU session modification procedure to indicate the support of Multi-homed IPv6 PDU session, the UE shall set the MH6-PDU bit to "Multi-homed IPv6 PDU session supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message; or

b) the UE is performing the PDU session modification procedure to indicate that Multi-homed IPv6 PDU session is not supported, the UE shall set the MH6-PDU bit to "Multi-homed IPv6 PDU session not supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message.

For a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is a UE operating in single-registration mode in a network supporting N26 interface, the PDU session is of "IPv4", "IPv6", "IPv4v6", or "Ethernet" PDU session type, and the UE supports more than 16 packet filters for this PDU session, the UE shall indicate the maximum number of packet filters supported for the PDU session in the Maximum number of supported packet filters IE of the PDU SESSION MODIFICATION REQUEST message.

For a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is a UE operating in single-registration mode in a network supporting N26 interface, the UE shall include the Integrity protection maximum data rate IE in the PDU SESSION MODIFICATION REQUEST message.

If the UE is performing the PDU session modification procedure

a) to request the deletion of a non-default QoS rule due to errors in QoS operations or packet filters;

b) to request the deletion of a QoS flow description due to errors in QoS operations; or

c) to request the deletion of a mapped EPS bearer context due to errors in mapped EPS bearer operation, TFT operation or packet filters,

the UE shall include the 5GSM cause IE in the PDU SESSION MODIFICATION REQUEST message as described in subclauses 6.3.2.3, 6.3.2.4 and 6.4.1.3.

When the UE-requested PDU session modification procedure is used to indicate a change of 3GPP PS data off UE status for a PDU session, the UE shall include the extended protocol configuration options IE in the PDU SESSION MODIFICATION REQUEST message and setting the 3GPP PS data off UE status.

For a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is a UE operating in single-registration mode in a network supporting N26 interface and the UE requests the PDU session to be an always-on PDU session in the 5GS, the UE shall include the Always-on PDU session requested IE and set the value of the IE to "Always-on PDU session requested" in the PDU SESSION MODIFICATION REQUEST message.

If a port management information container needs to be delivered (see 3GPP TS 23.501 [8] and 3GPP TS 23.502 [9]), the UE shall include a Port management information container IE in the PDU SESSION MODIFICATION REQUEST message.

To request re-negotiation of header compression configuration, the UE shall include the Header compression configuration IE in the PDU SESSION MODIFICATION REQUEST message if the network indicated "Control plane CIoT 5GS optimization supported" and "Header compression for control plane CIoT EPS5GS optimization supported" in the 5GS network support feature support IE.

The UE shall transport:

a) the PDU SESSION MODIFICATION REQUEST message;

b) the PDU session ID; and

c) if the UE-requested PDU session modification:

1) is not initiated to indicate a change of 3GPP PS data off UE status associated to a PDU session, then the request type set to "modification request"; and

2) is initiated to indicate a change of 3GPP PS data off UE status associated to a PDU session, then without transporting the request type;

using the NAS transport procedure as specified in subclause 5.4.5, and the UE shall start timer T3581 (see example in figure 6.4.2.2.1).

For a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is registered in a network supporting the ATSSS,

a) the UE may request to modify a PDU session to an MA PDU session; or

b) the may UE allow the network to upgrade the PDU session to an MA PDU session. In order for the UE to allow the network to upgrade the PDU session to an MA PDU session, the UE shall set "MA PDU session network upgrade allowed" in the MA PDU session information IE and set the request type to "modification request" in the UL NAS TRANSPORT message.

In case UE executes case a) or b):

1) if the UE supports ATSSS Low-Layer functionality with any steering mode as specified in subclause 5.32.6 of 3GPP TS 23.501 [8], the UE shall set the ATSSS-ST bits to "ATSSS Low-Layer functionality with any steering mode supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message;

2) if the UE supports MPTCP functionality with any steering mode and ATSSS-LL functionality with only Active-Standby steering mode as specified in subclause 5.32.6 of 3GPP TS 23.501 [8], the UE shall set the ATSSS-ST bits to "MPTCP functionality with any steering mode and ATSSS-LL functionality with only Active-Standby steering mode supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message; and

3) if the UE supports MPTCP functionality with any steering mode and ATSSS-LL functionality with any steering mode as specified in subclause 5.32.6 of 3GPP TS 23.501 [8], the UE shall set the ATSSS-ST bits to "MPTCP functionality with any steering mode and ATSSS-LL functionality with any steering mode supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message.



Figure 6.4.2.2.1: UE-requested PDU session modification procedure

\* \* \* Next Change \* \* \* \*

##### 6.4.2.4.2 Handling of network rejection due to congestion control

If:

- the 5GSM cause value #26 "insufficient resources" and the Back-off timer value IE are included in the PDU SESSION MODIFICATION REJECT message; or

- an indication that the 5GSM message was not forwarded due to DNN based congestion control is received along a Back-off timer value and a PDU SESSION MODIFICATION REQUEST message with the PDU session ID IE set to the PDU session ID of the PDU session;

the UE shall ignore the Re-attempt indicator IE or the 5GSM congestion re-attempt indicator IE provided by the network, if any, and the UE shall take different actions depending on the timer value received for timer T3396 in the Back-off timer value IE or depending on the Back-off timer value received from the 5GMM sublayer (if the UE is a UE configured for high priority access in selected PLMN, exceptions are specified in subclause 6.2.7):

a) If the timer value indicates neither zero nor deactivated and a DNN was provided during the PDU session establishment, the UE shall stop timer T3396 associated with the corresponding DNN, if it is running. If the timer value indicates neither zero nor deactivated and no DNN was provided during the PDU session establishment and the request type was different from "initial emergency request" and different from "existing emergency PDU session", the UE shall stop timer T3396 associated with no DNN if it is running. The UE shall then start timer T3396 with the value provided in the Back-off timer value IE or with the Back-off timer value received from the 5GMM sublayer and:

1) shall not send another PDU SESSION ESTABLISHMENT REQUEST message, or PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for the same DNN that was sent by the UE, until timer T3396 expires or timer T3396 is stopped; and

2) shall not send another PDU SESSION ESTABLISHMENT REQUEST message without a DNN and with request type different from "initial emergency request" and different from "existing emergency PDU session", or another PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for a non-emergency PDU session established without a DNN provided by the UE, if no DNN was provided during the PDU session establishment and the request type was different from "initial emergency request" and different from "existing emergency PDU session", until timer T3396 expires or timer T3396 is stopped.

The UE shall not stop timer T3396 upon a PLMN change or inter-system change.

b) if the timer value indicates that this timer is deactivated and a DNN was provided during the PDU session establishment, the UE shall stop timer T3396 associated with the corresponding DNN, if it is running. If the timer value indicates that this timer is deactivated and no DNN was provided during the PDU session establishment and the request type was different from "initial emergency request" and different from "existing emergency PDU session", the UE shall stop timer T3396 associated with no DNN if it is running. The UE:

1) shall not send another PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST with exception of those identified in subclause 6.4.2.1, for the same DNN until the UE is switched off or the USIM is removed, or the UE receives a PDU SESSION MODIFICATION COMMAND message for the same DNN from the network or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE for the same DNN from the network; and

2) shall not send another PDU SESSION ESTABLISHMENT REQUEST message without a DNN and with request type different from "initial emergency request" and different from "existing emergency PDU session", or another PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for a non-emergency PDU session established without a DNN provided by the UE, if no DNN was provided during the PDU session establishment and the request type was different from "initial emergency request" and different from "existing emergency PDU session", until the UE is switched off or the USIM is removed, or the UE receives a PDU SESSION MODIFICATION COMMAND message for a non-emergency PDU session established without a DNN provided by the UE, or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE for a non-emergency PDU session established without a DNN provided by the UE.

The timer T3396 remains deactivated upon a PLMN change or inter-system change.

c) if the timer value indicates zero, the UE:

1) shall stop timer T3396 associated with the corresponding DNN, if running, and may send another PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST message for the same DNN; and

2) if no DNN was provided during the PDU session establishment and the request type was different from "initial emergency request" and different from "existing emergency PDU session", the UE shall stop timer T3396 associated with no DNN, if running, and may send another PDU SESSION ESTABLISHMENT REQUEST message without a DNN, or another PDU SESSION MODIFICATION REQUEST message without a DNN provided by the UE.

If the Back-off timer value IE is not included or no Back-off timer value is received from the 5GMM sublayer, then the UE may send another PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST message for the same DNN or without a DNN.

If the timer T3396 is running when the UE enters state 5GMM-DEREGISTERED, the UE remains switched on, and the USIM in the UE remains the same, then timer T3396 is kept running until it expires or it is stopped

When the timer T3396 is running or the timer is deactivated, the UE is allowed to initiate a PDU session establishment procedure for emergency services.

If the UE is switched off when the timer T3396 is running, and if the USIM in the UE remains the same when the UE is switched on, the UE shall behave as follows:

- let t1 be the time remaining for T3396 timeout at switch off and let t be the time elapsed between switch off and switch on. If t1 is greater than t, then the timer shall be restarted with the value t1 – t. If t1 is equal to or less than t, then the timer need not be restarted. If the UE is not capable of determining t, then the UE shall restart the timer with the value t1.

If the UE is a UE operating in single-registration mode in a network supporting N26 interface and the PDU SESSION MODIFICATION REQUEST message was sent for a PDN connection established when in S1 mode after the first inter-system change from S1 mode to N1 mode and timer T3396 associated with the corresponding DNN (or no DNN) is running, then the UE shall re-initiate the UE-requested PDU session modification procedure after expiry of timer T3396.

If:

- the 5GSM cause value #67 "insufficient resources for specific slice and DNN" and the Back-off timer value IE are included in the PDU SESSION MODIFICATION REJECT message; or

- an indication that the 5GSM message was not forwarded due to S-NSSAI and DNN based congestion control is received along a Back-off timer value and a PDU SESSION MODIFICATION REQUEST message with the PDU session ID IE set to the PDU session ID of the PDU session;

the UE shall ignore the Re-attempt indicator IE provided by the network, if any, and take different actions depending on the timer value received for timer T3584 in the Back-off timer value IE or depending on the Back-off timer value received from the 5GMM sublayer (if the UE is a UE configured for high priority access in selected PLMN, exceptions are specified in subclause 6.2.8):

a) If the timer value indicates neither zero nor deactivated, the UE shall stop timer T3584 associated with the same [S-NSSAI, DNN] combination as that the UE provided during the PDU session establishment, if it is running. If the timer value indicates neither zero nor deactivated and no DNN was provided during the PDU session establishment and the request type was different from "initial emergency request" and different from "existing emergency PDU session", the UE shall stop timer T3584 associated with [S-NSSAI, no DNN] combination as that the UE provided during the PDU session establishment, if it is running. If the timer value indicates neither zero nor deactivated and no S-NSSAI was provided during the PDU session establishment, the UE shall stop timer T3584 associated with [no S-NSSAI, DNN] combination as that the UE provided during the PDU session establishment, if it is running. If the timer value indicates neither zero nor deactivated and neither S-NSSAI nor DNN was provided during the PDU session establishment and the request type was different from "initial emergency request" and different from "existing emergency PDU session", the UE shall stop timer T3584 associated with [no S-NSSAI, no DNN] combination as that the UE provided during the PDU session establishment, if it is running. The UE shall then start timer T3584 with the value provided in the Back-off timer value IE or with the Back-off timer value received from the 5GMM sublayer and:

1) shall not send another PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for the same [S-NSSAI, DNN] combination that was sent by the UE, until timer T3584 expires or timer T3584 is stopped;

2) shall not send another PDU SESSION ESTABLISHMENT REQUEST message with request type different from "initial emergency request" and different from "existing emergency PDU session", or another PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for the same [S-NSSAI, no DNN] combination that was sent by the UE, if no DNN was provided during the PDU session establishment, until timer T3584 expires or timer T3584 is stopped;

3) shall not send another PDU SESSION ESTABLISHMENT REQUEST message, or another PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for the same [no S-NSSAI, DNN] combination that was sent by the UE, if no S-NSSAI was provided during the PDU session establishment, until timer T3584 expires or timer T3584 is stopped; and

4) shall not send another PDU SESSION ESTABLISHMENT REQUEST message with request type different from "initial emergency request" and different from "existing emergency PDU session", or another PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for the same [no S-NSSAI, no DNN] combination that was sent by the UE, if neither S-NSSAI nor DNN was provided during the PDU session establishment, until timer T3584 expires or timer T3584 is stopped.

The UE shall not stop timer T3584 upon a PLMN change or inter-system change.

b) if the timer value indicates that this timer is deactivated, the UE:

1) shall stop timer T3584 associated with the same [S-NSSAI, DNN] combination as that the UE provided during the PDU session establishment, if it is running. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for the same [S-NSSAI, DNN] combination that was sent by the UE, until the UE is switched off or the USIM is removed, or the UE receives a PDU SESSION MODIFICATION COMMAND message for the same [S-NSSAI, DNN] combination from the network or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE for the same [S-NSSAI, DNN] combination from the network;

2) shall stop timer T3584 associated with the same [S-NSSAI, no DNN] combination as that the UE provided during the PDU session establishment, if it is running. The UE shall not send a PDU SESSION ESTABLISHMENT REQUEST message with request type different from "initial emergency request" and different from "existing emergency PDU session", or a PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for the same [S-NSSAI, no DNN] combination that was sent by the UE, if no DNN was provided during the PDU session establishment, until the UE is switched off or the USIM is removed, or the UE receives an PDU SESSION MODIFICATION COMMAND message for a non-emergency PDU session established for the same [S-NSSAI, no DNN] combination from the network or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE for a non-emergency PDU session established for the same [S-NSSAI, no DNN] combination from the network;

3) shall stop timer T3584 associated with the same [no S-NSSAI, DNN] combination as that the UE provided during the PDU session establishment, if it is running. The UE shall not send a PDU SESSION ESTABLISHMENT REQUEST message, or a PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for the same [no S-NSSAI, DNN] combination that was sent by the UE, if no S-NSSAI was provided during the PDU session establishment, until the UE is switched off or the USIM is removed, or the UE receives an PDU SESSION MODIFICATION COMMAND message for the same [no S-NSSAI, DNN] combination from the network or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE for the same [no S-NSSAI, DNN] combination from the network; and

4) shall stop timer T3584 associated with the same [no S-NSSAI, no DNN] combination as that the UE provided during the PDU session establishment, if it is running. The UE shall not send a PDU SESSION ESTABLISHMENT REQUEST message with request type different from "initial emergency request" and different from "existing emergency PDU session", or a PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for the same [no S-NSSAI, no DNN] combination that was sent by the UE, if neither S-NSSAI nor DNN was provided during the PDU session establishment, until the UE is switched off or the USIM is removed, or the UE receives an PDU SESSION MODIFICATION COMMAND message for a non-emergency PDU session established for the same [no S-NSSAI, no DNN] combination from the network or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE for a non-emergency PDU session established for the same [no S-NSSAI, no DNN] combination from the network.

The timer T3584 remains deactivated upon a PLMN change or inter-system change.

c) if the timer value indicates zero, the UE:

1) shall stop timer T3584 associated with the same [S-NSSAI, DNN] combination as that the UE provided during the PDU session establishment, if it is running. The UE may send another PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST message for the same [S-NSSAI, DNN] combination;

2) shall stop timer T3584 associated with the same [S-NSSAI, no DNN] combination as that the UE provided during the PDU session establishment, if it is running. The UE may send another PDU SESSION ESTABLISHMENT REQUEST message, or PDU SESSION MODIFICATION REQUEST message for the same [S-NSSAI, no DNN] combination if no DNN was provided during the PDU session establishment and the request type was different from "initial emergency request" and different from "existing emergency PDU session";

3) shall stop timer T3584 associated with the same [no S-NSSAI, DNN] combination as that the UE provided during the PDU session establishment, if it is running. The UE may send another PDU SESSION ESTABLISHMENT REQUEST message, or PDU SESSION MODIFICATION REQUEST message for the same [no S-NSSAI, DNN] combination if no NSSAI was provided during the PDU session establishment; and

4) shall stop timer T3584 associated with the same [no S-NSSAI, no DNN] combination as that the UE provided during the PDU session establishment, if it is running. The UE may send another PDU SESSION ESTABLISHMENT REQUEST message, or PDU SESSION MODIFICATION REQUEST message for the same [no S-NSSAI, no DNN] combination if neither S-NSSAI nor DNN was provided during the PDU session establishment and the request type was different from "initial emergency request" and different from "existing emergency PDU session".

If the 5GSM congestion re-attempt indicator IE set to "The back-off timer is applied in all PLMNs" is included in the PDU SESSION MODIFICATION REJECT message with the 5GSM cause value #67 "insufficient resources for specific slice and DNN", then the UE shall apply the timer T3584 for all the PLMNs. Otherwise, the UE shall apply the timer T3584 for the registered PLMN.

If the Back-off timer value IE is not included or no Back-off timer value is received from the 5GMM sublayer, then the UE may send another PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST message for the same [S-NSSAI, DNN] combination, or for the same [S-NSSAI, no DNN] combination, or for the same [no S-NSSAI, DNN] combination, or for the same [no S-NSSAI, no DNN] combination.

When the timer T3584 is running or the timer is deactivated, the UE is allowed to initiate a PDU session establishment procedure for emergency services.

If the timer T3584 is running when the UE enters state 5GMM-DEREGISTERED, the UE remains switched on, and the USIM in the UE remains the same, then timer T3584 is kept running until it expires or it is stopped.

If the UE is switched off when the timer T3584 is running, and if the USIM in the UE remains the same when the UE is switched on, the UE shall behave as follows:

- let t1 be the time remaining for T3584 timeout at switch off and let t be the time elapsed between switch off and switch on. If t1 is greater than t, then the timer shall be restarted with the value t1 – t. If t1 is equal to or less than t, then the timer need not be restarted. If the UE is not capable of determining t, then the UE shall restart the timer with the value t1.

If the UE is a UE operating in single-registration mode in a network supporting N26 interface and the PDU SESSION MODIFICATION REQUEST message was sent for a PDN connection established when in S1 mode after the first inter-system change from S1 mode to N1 mode and timer T3584 associated with the corresponding [no S-NSSAI, DNN] combination or [no S-NSSAI, no DNN] combination is running, then the UE shall re-initiate the UE-requested PDU session modification procedure after expiry of timer T3584.

If:

- the 5GSM cause value #69 "insufficient resources for specific slice" and the Back-off timer value IE are included in the PDU SESSION MODIFICATION REJECT message; or

- an indication that the 5GSM message was not forwarded due to S-NSSAI only based congestion control is received along a Back-off timer value and a PDU SESSION MODIFICATION REQUEST message with the PDU session ID IE set to the PDU session ID of the PDU session;

the UE shall ignore the bit "RATC" and the bit "EPLMNC" in the Re-attempt indicator IE provided by the network, if any, and take different actions depending on the timer value received for timer T3585 in the Back-off timer value IE or depending on the Back-off timer value received from the 5GMM sublayer (if the UE is a UE configured for high priority access in selected PLMN, exceptions are specified in subclause 6.2.8):

a) If the timer value indicates neither zero nor deactivated and an S-NSSAI was provided during the PDU session establishment and the request type was different from "initial emergency request" and different from "existing emergency PDU session", the UE shall stop timer T3585 associated with the corresponding S-NSSAI, if it is running. If the timer value indicates neither zero nor deactivated and no S-NSSAI was provided during the PDU session establishment and the request type was different from "initial emergency request" and different from "existing emergency PDU session", the UE shall stop timer T3585 associated with no S-NSSAI if it is running. The UE shall then start timer T3585 with the value provided in the Back-off timer value IE or with the Back-off timer value received from the 5GMM sublayer and:

1) shall not send another PDU SESSION ESTABLISHMENT REQUEST message with request type different from "initial emergency request" and different from "existing emergency PDU session", or another PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for a non-emergency PDU session for the same S-NSSAI that was sent by the UE, until timer T3585 expires or timer T3585 is stopped; and

2) shall not send another PDU SESSION ESTABLISHMENT REQUEST message without an S-NSSAI and with request type different from "initial emergency request" and different from "existing emergency PDU session", or another PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for a non-emergency PDU session established without an S-NSSAI provided by the UE, if no S-NSSAI was provided during the PDU session establishment and the request type was different from "initial emergency request" and different from "existing emergency PDU session", until timer T3585 expires or timer T3585 is stopped.

The UE shall not stop timer T3585 upon a PLMN change or inter-system change.

b) if the timer value indicates that this timer is deactivated and an S-NSSAI was provided during the PDU session establishment and the request type was different from "initial emergency request" and different from "existing emergency PDU session", the UE shall stop timer T3585 associated with the corresponding S-NSSAI, if it is running. If the timer value indicates that this timer is deactivated and no S-NSSAI was provided during the PDU session establishment and the request type was different from "initial emergency request" and different from "existing emergency PDU session", the UE shall stop timer T3585 associated with no S-NSSAI if it is running. The UE:

1) shall not send another PDU SESSION ESTABLISHMENT REQUEST message with request type different from "initial emergency request" and different from "existing emergency PDU session", or another PDU SESSION MODIFICATION REQUEST with exception of those identified in subclause 6.4.2.1, for a non-emergency PDU session for the same S-NSSAI until the UE is switched off or the USIM is removed, or the UE receives a PDU SESSION MODIFICATION COMMAND message for a non-emergency PDU session for the same S-NSSAI from the network or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE for the same S-NSSAI from the network; and

2) shall not send another PDU SESSION ESTABLISHMENT REQUEST message without an S-NSSAI and with request type different from "initial emergency request" and different from "existing emergency PDU session", or another PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for a non-emergency PDU session established without an S-NSSAI provided by the UE, if no S-NSSAI was provided during the PDU session establishment and the request type was different from "initial emergency request" and different from "existing emergency PDU session", until the UE is switched off or the USIM is removed, or the UE receives a PDU SESSION MODIFICATION COMMAND message for a non-emergency PDU session established without an S-NSSAI provided by the UE, or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE for a non-emergency PDU session established without an S-NSSAI provided by the UE.

The timer T3585 remains deactivated upon a PLMN change or inter-system change.

c) if the timer value indicates zero, the UE:

1) shall stop timer T3585 associated with the corresponding S-NSSAI, if running, and may send another PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST message for the same S-NSSAI; and

2) if no S-NSSAI was provided during the PDU session establishment and the request type was different from "initial emergency request " and different from "existing emergency PDU session", the UE shall stop timer T3585 associated with no S-NSSAI, if running, and may send another PDU SESSION ESTABLISHMENT REQUEST message without an S-NSSAI, or another PDU SESSION MODIFICATION REQUEST message without an S-NSSAI provided by the UE.

If the 5GSM congestion re-attempt indicator IE set to "The back-off timer is applied in all PLMNs" is included in the PDU SESSION MODIFICATION REJECT message with the 5GSM cause value #69 "insufficient resources for specific slice", then the UE shall apply the timer T3585 for all the PLMNs. Otherwise, the UE shall apply the timer T3585 for the registered PLMN.

If the Back-off timer value IE is not included or no Back-off timer value is received from the 5GMM sublayer, then the UE may send another PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST message for the same S-NSSAI or without an S-NSSAI.

When the timer T3585 is running or the timer is deactivated, the UE is allowed to initiate a PDU session establishment procedure for emergency services.

If the timer T3585 is running when the UE enters state 5GMM-DEREGISTERED, the UE remains switched on, and the USIM in the UE remains the same, then timer T3585 is kept running until it expires or it is stopped.

If the UE is switched off when the timer T3585 is running, and if the USIM in the UE remains the same when the UE is switched on, the UE shall behave as follows:

- let t1 be the time remaining for T3585 timeout at switch off and let t be the time elapsed between switch off and switch on. If t1 is greater than t, then the timer shall be restarted with the value t1 – t. If t1 is equal to or less than t, then the timer need not be restarted. If the UE is not capable of determining t, then the UE shall restart the timer with the value t1.

If the UE is a UE operating in single-registration mode in a network supporting N26 interface and the PDU SESSION MODIFICATION REQUEST message was sent for a PDN connection established when in S1 mode after the first inter-system change from S1 mode to N1 mode and timer T3585 associated with no S-NSSAI is running, then the UE shall re-initiate the UE-requested PDU session modification procedure after expiry of timer T3585.

NOTE: As described in this subclause, upon PLMN change or inter-system change, the UE does not stop the timer T3584 or T3585. This means the timer T3584 or T3585 can still be running or be deactivated for the given 5GSM procedure, the PLMN, the S-NSSAI and optionally the DNN combination when the UE returns to the PLMN or when it performs inter-system change back from S1 mode to N1 mode. Thus the UE can still be prevented from sending another PDU SESSION ESTABLISHMENT REQUEST or PDU SESSION MODIFICATION REQUEST message in the PLMN for the same S-NSSAI and optionally the same DNN.

Upon PLMN change, if T3584 is running or is deactivated for an S-NSSAI, a DNN, and old PLMN, but T3584 is not running and is not deactivated for the S-NSSAI, the DNN, and new PLMN, then the UE is allowed to send a PDU SESSION ESTABLISHMENT REQUEST message for the same S-NSSAI and the same DNN in the new PLMN.

Upon PLMN change, if T3585 is running or is deactivated for an S-NSSAI and old PLMN, but T3585 is not running and is not deactivated for the S-NSSAI and new PLMN, then the UE is allowed to send a PDU SESSION ESTABLISHMENT REQUEST message for the same S-NSSAI in the new PLMN.

\* \* \* Next Change \* \* \* \*

#### 8.3.7.2 5GSM capability

This IE is included in the message:

1) for a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is a UE operating in single-registration mode in a network supporting N26 interface and:

a) if the PDU session is of "IPv4", "IPv6", "IPv4v6" or "Ethernet" PDU session type, and the UE supports reflective QoS; or

b) if the PDU session is of "IPv6" or "IPv4v6" PDU session type, and the UE supports multi-homed IPv6 PDU session; or

2) if the UE needs to revoke the previously indicated support of reflective QoS.

\* \* \* Next Change \* \* \* \*

#### 8.3.7.4 Maximum number of supported packet filters

This IE shall be included in the message for a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is a UE operating in single-registration mode in a network supporting N26 interface, the PDU session type is "IPv4", "IPv6", "IPv4v6" or "Ethernet", and the UE can support more than 16 packet filters for this PDU session.

\* \* \* Next Change \* \* \* \*

#### 8.3.7.5 Always-on PDU session requested

This IE shall be included in the message for a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is a UE operating in single-registration mode in a network supporting N26 interface and the UE requests the PDU session to be an always-on PDU session in the 5GS.

\* \* \* Next Change \* \* \* \*

#### 8.3.7.6 Integrity protection maximum data rate

This IE shall be included in the message for a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, if the UE is a UE operating in single-registration mode in a network supporting N26 interface.

\* \* \* End of Change \* \* \* \*