ii) request the SMF to perform a local release of 3GPP access user plane resources of all those MA PDU sessions. If the MA PDU session is associated with one or more MBS sessions, the SMF shall consider the UE as removed from the associated MBS sessions.

5.6.3.4 Abnormal cases on the network side

The following abnormal cases can be identified:

a) Expiry of timer T3565.

The network shall, on the first expiry of the timer T3565, retransmit the NOTIFICATION message and shall reset and start timer T3565. This retransmission is repeated four times, i.e. on the fifth expiry of timer T3565, the procedure shall be aborted. In addition, upon the fifth expiry of timer T3565:

For case a) in subclause 5.6.3.1, the AMF should notify the SMF that the UE is unreachable. The AMF may enter 5GMM-IDLE mode over 3GPP access.

For case b) in subclause 5.6.3.1, the AMF may either:

1) perform the paging procedure over the 3GPP access; or

2) notify the SMF that the UE is unreachable.

NOTE: Whether the AMF performs the paging procedure or notifies the SMF is up to operator's policies.

b) De-registration procedure collision

If the network receives a DEREGISTRATION REQUEST message before it receives a SERVICE REQUEST message or REGISTRATION REQUEST message, the AMF shall stop timer T3565 and proceed de-registration procedure as specified in subclause 5.5.2.

5.6.3.5 Abnormal cases on the UE side

The following abnormal cases can be identified:

a) NOTIFICATION message received via non-3GPP access with access type indicating 3GPP access when UE-initiated 5GMM specific procedure or service request procedure over 3GPP access is ongoing.

The UE shall proceed with 5GMM specific procedure or service request procedure. If for registration procedure and service requestprocedure lower layers indicate that the access attempt is barred, then the UE shall handle the pending NOTIFICATION message as specified in subclause 5.6.3.2. Otherwise, the UE shall ignore the NOTIFICATION message once lower layers confirms the establishment of the signalling connection.

x) NOTIFICATION message received via non-3GPP access with access type indicating 3GPP access when the unavailability period is activated in the UE or the UE is about to activate unavailability period.

The UE shall respond with NOTIFICATION RESPONSE message over non-3GPP access indicating inability of the UE to initiate a service request procedure or a registration procedure over 3GPP access.

6 Elementary procedures for 5GS session management

6.1 Overview

6.1.1 General

This clause describes the procedures used for 5GS session management (5GSM) performed over an N1 NAS signalling connection.

The main function of the 5GSM sublayer is to support the PDU session handling in the UE and in the SMF (transferred via the AMF).

The 5GSM comprises procedures for:

- the authentication and authorization, establishment, modification and release of PDU sessions; and
- request for performing handover of an existing PDU session between 3GPP access and non-3GPP access, or to transfer an existing PDN connection in the EPS to the 5GS.

Each PDU session represents a PDU session established between the UE and an SMF. PDU sessions can remain established even if the radio and network resources constituting the corresponding PDU session between the UE and the SMF are temporarily released.

5GSM procedures can be performed only if a 5GMM context has been established between the UE and the AMF, and the secure exchange of NAS messages has been initiated by the AMF by use of the 5GMM procedures described in clause 5. Once the UE is successfully registered to a PLMN, a PDU session can be established. If no 5GMM context has been established, the 5GMM sublayer has to initiate the establishment of a 5GMM context by use of the 5GMM procedures as described in clause 5.

The UE can request the network to modify or release PDU sessions. The network can fulfil such a request from the UE by modifying a PDU session or releasing a PDU session using network-requested procedures (see subclause 6.3).

6.1.2 Types of 5GSM procedures

Three types of 5GSM procedures can be distinguished:

a) Procedures related to PDU sessions:

These procedures are initiated by the network and are used for authentication and authorization or manipulation of PDU sessions:

1) PDU authentication and authorization;
2) network-requested PDU session modification;
3) network-requested PDU session release; and
4) service-level authentication and authorization.

This procedure is initiated by the UE and to request for establishment of PDU sessions or to perform handover of an existing PDU session between 3GPP access and non-3GPP access, or to transfer an existing PDN connection in the EPS to the 5GS:

UE-requested PDU session establishment.

b) Transaction related procedures:

These procedures are initiated by the UE to request for handling of PDU sessions, i.e. to modify a PDU session, or to release a PDU session:

1) UE-requested PDU session modification; and
2) UE-requested PDU session release.

This procedure is initiated by the 5G ProSe UE-to-network relay UE and is used for the manipulation of PDU sessions:

- remote UE report.

A successful transaction related procedure initiated by the UE triggers the network to execute one of the following procedures related to PDU session; network-requested PDU session modification procedure or network-requested PDU session release procedure. The UE treats the start of the procedure related to the PDU session as completion of the transaction related procedure.

c) Common procedure:

The following 5GSM procedure can be related to a PDU session or to a procedure transaction:

5GSM status procedure.

6.1.3 5GSM sublayer states

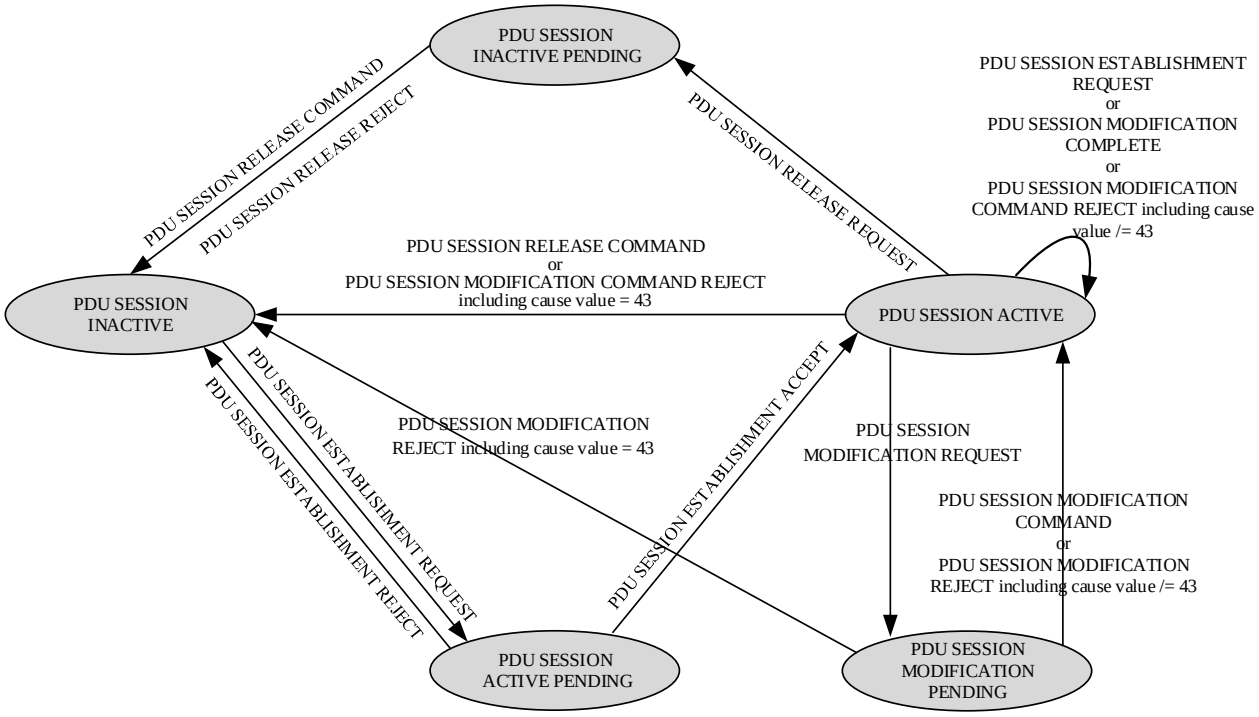
6.1.3.1 General

In the following subclauses, the possible states of a PDU session in the UE and the network side are described.

6.1.3.2 5GSM sublayer states in the UE

6.1.3.2.1 Overview

In the following subclauses, the possible 5GSM sublayer states of the UE are described and shown in figure 6.1.3.2.1.1.



NOTE 1: Not all possible transitions are shown in this figure.
NOTE 2: Some transitions shown in this figure are not applicable to the MA PDU session.

Figure 6.1.3.2.1.1: The 5GSM sublayer states for PDU session handling in the UE (overview)

6.1.3.2.2 PDU SESSION INACTIVE

No PDU session exists.

6.1.3.2.3 PDU SESSION ACTIVE PENDING

The UE has initiated a PDU session establishment procedure towards the network and is waiting for a response from the network.

6.1.3.2.4 PDU SESSION ACTIVE

The PDU session is active in the UE.

6.1.3.2.5 PDU SESSION INACTIVE PENDING

The UE has initiated a PDU session release procedure towards the network and is waiting for a response from the network.

6.1.3.2.6 PDU SESSION MODIFICATION PENDING

The UE has initiated a PDU session modification procedure towards the network and is waiting for a response from the network.

6.1.3.2.7 PROCEDURE TRANSACTION INACTIVE

No procedure transaction exists.

6.1.3.2.8 PROCEDURE TRANSACTION PENDING

The UE has initiated a procedure transaction towards the network.

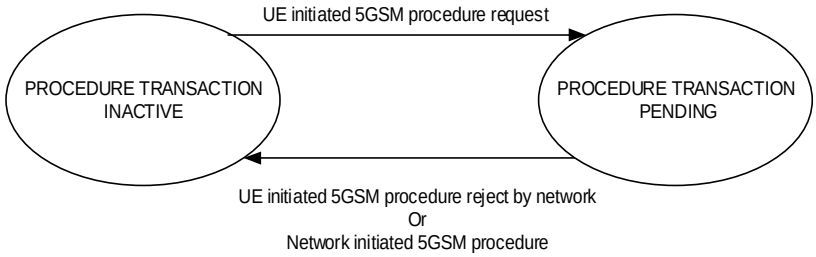
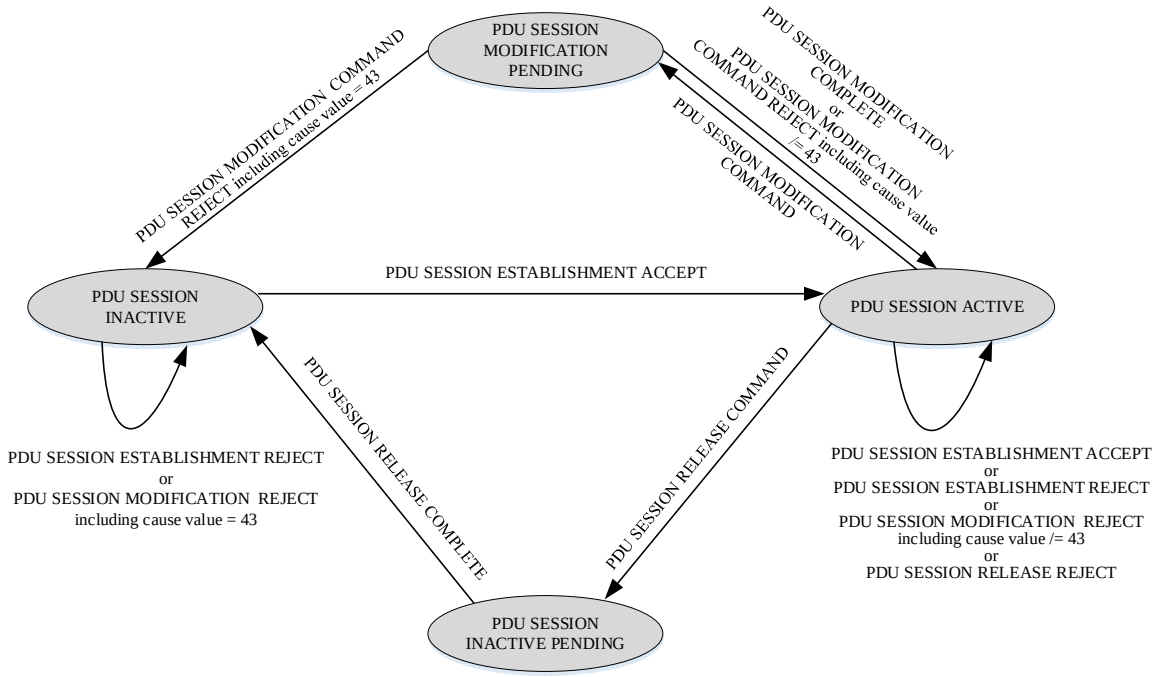


Figure 6.1.3.2.8.1: The procedure transaction states in the UE (overview)

6.1.3.3 5GSM sublayer states in the network side

6.1.3.3.1 Overview

In the following subclauses, the possible 5GSM sublayer states of the network are described and shown in Figure 6.1.3.3.1.1.



NOTE 1: Not all possible transitions are shown in this figure.
NOTE 2: Some transitions shown in this figure are not applicable to the MA PDU session.

Figure 6.1.3.3.1.1: The 5GSM sublayer states for PDU session handling in the network (overview)

6.1.3.3.2 PDU SESSION INACTIVE

No PDU session exists.

6.1.3.3.3 PDU SESSION ACTIVE

The PDU session is active in the network.

6.1.3.3.4 PDU SESSION INACTIVE PENDING

The network has initiated a PDU session release procedure towards the UE and is waiting for a response from the UE.

6.1.3.3.5 PDU SESSION MODIFICATION PENDING

The network has initiated a PDU session modification procedure towards the UE and is waiting for a response from the UE.

6.1.3.3.6 PROCEDURE TRANSACTION INACTIVE

No procedure transaction exists.

6.1.3.3.7 PROCEDURE TRANSACTION PENDING

The network has initiated a procedure transaction towards the UE.

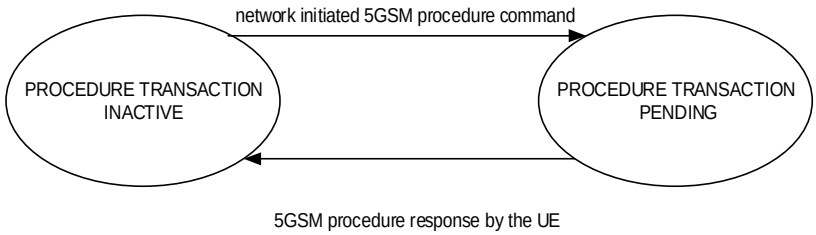


Figure 6.1.3.3.7.1: The procedure transaction states in the network (overview)

6.1.4 Coordination between 5GSM and ESM

6.1.4.1 Coordination between 5GSM and ESM with N26 interface

Interworking with EPS is supported for a PDU session, if the PDU session includes the mapped EPS bearer context(s) or has association(s) between QoS flow and mapped EPS bearer after inter-system change from S1 mode to N1 mode. The SMF shall not include any mapped EPS bearer contexts associated with a PDU session for LADN, with a PDU session which is a multi-homed IPv6 PDU session, and with a PDU session with the selected SSC mode set to "SSC mode 2" or "SSC mode 3". If the UE receives any mapped EPS bearer context for a PDU session for LADN, for a multi-homed IPv6 PDU session, or for a PDU session with the selected SSC mode set to "SSC mode 2" or "SSC mode 3", the UE may locally delete the mapped EPS bearer context. See coding of the Mapped EPS bearer contexts IE in subclause 9.11.4.8. In an MA PDU session, the UE shall have one set of the mapped EPS bearer contexts. The network can provide the set of the mapped EPS bearer contexts of the MA PDU session via either access of the MA PDU session. In an MA PDU session, the UE shall support modification or deletion via an access of a mapped EPS bearer context of the MA PDU session created via the same or the other access.

Upon inter-system change from N1 mode to S1 mode, the UE shall create the default EPS bearer context and the dedicated EPS bearer context(s) based on the parameters of the mapped EPS bearer contexts or the associations between QoS flow and mapped EPS bearer in the PDU session, if available. The EPS bearer identity assigned for the QoS flow of the default QoS rule becomes the EPS bearer identity of the default bearer in the corresponding PDN connection. If there is no EPS bearer identity assigned to the QoS flow of the default QoS rule of a PDU session associated with 3GPP access, or if there is no corresponding mapped EPS bearer contexts associated with the EPS bearer identity assigned to the QoS flow of the default QoS rule of a PDU session associated with 3GPP access:

a) the PDU session is not an MA PDU session established over both 3GPP access and non-3GPP access, the UE shall perform a local release of the PDU session; or

b) the PDU session is an MA PDU session established over both 3GPP access and non-3GPP access, the UE shall perform a local release of the PDU session over 3GPP access and consider that the MA PDU session is established over non-3GPP access only.

If there is no EPS bearer identity assigned to the QoS flow(s) of a PDU session associated with 3GPP access which is not associated with the default QoS rule, or if there is no corresponding mapped EPS bearer contexts associated with the EPS bearer identity assigned to the QoS flow of the non-default QoS rule of a PDU session associated with 3GPP access, unless the PDU session is an MA PDU session established over 3GPP access and over non-3GPP access, the UE shall locally delete the QoS rules and the QoS flow description(s). The UE uses the parameters from each PDU session for which interworking with EPS is supported to create corresponding default EPS bearer context and optionally dedicated EPS bearer context(s) as follows:

a) the PDU session type of the PDU session shall be mapped to the PDN type of the default EPS bearer context as follows:

   1) the PDN type shall be set to "non-IP" if the PDU session type is "Unstructured";

   2) the PDN type shall be set to "IPv4" if the PDU session type is "IPv4";

   3) the PDN type shall be set to "IPv6" if the PDU session type is "IPv6";

   4) the PDN type shall be set to "IPv4v6" if the PDU session type is "IPv4v6";

5) the PDN type shall be set to "non-IP" if the PDU session type is "Ethernet", and the UE, the network or both of them do not support Ethernet PDN type in S1 mode; and

6) the PDN type shall be set to "Ethernet" if the PDU session type is "Ethernet" and the UE and the network support Ethernet PDN type in S1 mode;

b) the PDU address of the PDU session shall be mapped to the PDN address of the default EPS bearer context as follows:

1) the PDN address of the default EPS bearer context is set to the PDU address of the PDU session, if the PDU session type is "IPv4", "IPv6" or "IPv4v6"; and

2) the PDN address of the default EPS bearer context is set to zero, if the PDU session type is "Ethernet" or "Unstructured";

c) the DNN of the PDU session shall be mapped to the APN of the default EPS bearer context, unless the PDU session is an emergency PDU session;

d) the APN-AMBR and extended APN-AMBR received in the parameters of the default EPS bearer context of the mapped EPS bearer contexts shall be mapped to the APN-AMBR and extended APN-AMBR of the default EPS bearer context;

e) for each PDU session in state PDU SESSION ACTIVE, PDU SESSION MODIFICATION PENDING or PDU SESSION INACTIVE PENDING:

1) if the UE is performing an inter-system change from N1 mode to WB-S1 mode, the UE shall set the state of the mapped EPS bearer context(s) to BEARER CONTEXT ACTIVE; or

2) if the UE is performing an inter-system change from N1 mode to NB-S1 mode, for the mapped EPS bearer context corresponding to the default EPS bearer, the UE shall set the state of the mapped EPS bearer context to BEARER CONTEXT ACTIVE. Additionally, if the UE is performing an inter-system change from WB-N1 mode to NB-S1 mode, for the mapped EPS bearer context corresponding to a dedicated EPS bearer, if any, the UE shall set the state of the mapped EPS bearer context to BEARER CONTEXT INACTIVE; and

f) for any other PDU session the UE shall set the state of the mapped EPS bearer context(s) to BEARER CONTEXT INACTIVE.

Additionally, for each mapped EPS bearer context or the association between QoS flow and mapped EPS bearer in the PDU session:

a) the EPS bearer identity shall be set to the EPS bearer identity received in the mapped EPS bearer context, or the EPS bearer identity associated with the QoS flow;

b) the EPS QoS parameters shall be set to the mapped EPS QoS parameters of the EPS bearer received in the mapped EPS bearer context, or the EPS QoS parameters associated with the QoS flow;

c) the extended EPS QoS parameters shall be set to the mapped extended EPS QoS parameters of the EPS bearer received in the mapped EPS bearer context, or the extended EPS QoS parameters associated with the QoS flow; and

d) the traffic flow template shall be set to the mapped traffic flow template of the EPS bearer received in the mapped EPS bearer context, or the stored traffic flow template associated with the QoS flow, if available.

After inter-system change from N1 mode to S1 mode, the UE shall associate the PDU session identity, the S-NSSAI, and the session-AMBR with the default EPS bearer context, and for each EPS bearer context mapped from one or more QoS flows, associate the QoS rule(s) for the QoS flow(s) and the QoS flow description(s) for the QoS flow(s) with the EPS bearer context.

If the PDU session is associated with the control plane only indication and supports interworking with EPS, after inter-system change from N1 mode to S1 mode, the UE shall associate the EPS bearer context(s) of the PDN connection corresponding to the PDU session with the control plane only indication.

If the PDU session is associated with a PDU session pair ID, after inter-system change from N1 mode to S1 mode, the UE shall associate the default EPS bearer context of the PDN connection corresponding to the PDU session with the PDU session pair ID. If the PDU session is associated with an RSN, after inter-system change from N1 mode to S1

mode, the UE shall associate the default EPS bearer context of the PDN connection corresponding to the PDU session with the RSN.

After inter-system change from N1 mode to S1 mode, if:

a) the UE sent the URSP provisioning in EPS support indicator and received the URSP provisioning in EPS support indicator in the PDU session; or

b) the PDU session is associated with the URSP provisioning in EPS support indicators;

the UE shall associate the default EPS bearer context of the PDN connection corresponding to the PDU session with the URSP provisioning in EPS support indicators.

After inter-system change from N1 mode to S1 mode, the UE and the SMF shall maintain the PDU session type of the PDU session until the PDN connection corresponding to the PDU session is released if the UE supports non-IP PDN type and the PDU session type is "Ethernet" or "Unstructured".

After inter-system change from N1 mode to S1 mode, the UE and the SMF shall maintain the following 5GSM attributions and capabilities associated with the PDU session until the PDN connection corresponding to the PDU session is released:

a) the always-on PDU session indication;

b) the maximum number of supported packet filters;

c) the support of reflective QoS;

d) the maximum data rate per UE for user-plane integrity protection supported by the UE for uplink and the maximum data rate per UE for user-plane integrity protection supported by the UE for downlink;

e) the support of multi-homed IPv6 PDU session; and

f) if the PDU session is an MA PDU session established over 3GPP access, the PDN connection of the default EPS bearer corresponding to the MA PDU session shall be considered as a user-plane resource of the MA PDU session.

After inter-system change from N1 mode to S1 mode, the UE operating in single-registration mode in a network supporting N26 interface shall deem that the following features are supported by the network on the PDN connection corresponding to the PDU session:

a) PS data off; and

b) Local address in TFT.

If there is a QoS flow used for IMS signalling, after inter-system change from N1 mode to S1 mode, the EPS bearer associated with the QoS flow for IMS signalling becomes the EPS bearer for IMS signalling.

When the UE is provided with a new session-AMBR in the Protocol configuration options IE or Extended protocol configuration options IE in the MODIFY EPS BEARER CONTEXT REQUEST message, the UE shall discard the corresponding association and associate the new valuewith the default EPS bearer context.

The network may provide the UE with one or more QoS rules by including either one QoS rules parameter, or one QoS rules with the length of two octets parameter, but not both, in the Protocol configuration options IE or Extended protocol configuration options IE in the MODIFY EPS BEARER CONTEXT REQUEST message. The network may provide the UE with one or more QoS flow descriptions corresponding to the EPS bearer context being modified, by including either one QoS flow descriptions parameter, or one QoS flow descriptions with the length of two octets parameter, but not both, in the Protocol configuration options IE or Extended protocol configuration options IE in the MODIFY EPS BEARER CONTEXT REQUEST message.

When the UE is provided with one or more QoS flow descriptions or the EPS bearer identity of an existing QoS flow description is modified in the Protocol configuration options IE or Extended protocol configuration options IE in the MODIFY EPS BEARER CONTEXT REQUEST message, the UE shall check the EPS bearer identity included in the QoS flow description; and:

a) if the EPS bearer identity corresponds to the EPS bearer context being modified or the EPS bearer identity is not included, the UE shall store the QoS flow description and all the associated QoS rules, if any, for the EPS bearer context being modified for use during inter-system change from S1 mode to N1 mode; and

b) otherwise the UE shall locally delete the QoS flow description and all the associated QoS rules, if any, and include a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause parameter set to 5GSM cause #84 "syntactical error in the QoS operation" in the MODIFY EPS BEARER CONTEXT ACCEPT message.

When the UE is provided with one or more QoS rules, or one or more QoS flow descriptions in the Protocol configuration options IE or Extended protocol configuration options IE in the MODIFY EPS BEARER CONTEXT REQUEST message, the UE shall process the QoS rules sequentially starting with the first QoS rule and shall process the QoS flow descriptions sequentially starting with the first QoS flow description. The UE shall check the QoS rules and QoS flow descriptions for different types of errors as follows:

NOTE 1: If an error is detected in a QoS rule or a QoS flow description which requires sending a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause value, then the QoS rules parameter, the QoS rules with the length of two octets parameter, the QoS flow descriptions parameter and the QoS flow descriptions with the length of two octets parameter included in the Protocol configuration options IE or Extended protocol configuration options IE in the MODIFY EPS BEARER CONTEXT REQUEST message are discarded, if any.

NOTE 2: If the EPS bearer context modification procedure is rejected, then the QoS rules parameter, the QoS rules with the length of two octets parameter, the QoS flow descriptions parameter and the QoS flow descriptions with the length of two octets parameter included in the Protocol configuration options IE or Extended protocol configuration options IE in the MODIFY EPS BEARER CONTEXT REQUEST message are discarded, if any.

a) Semantic errors in QoS operations:

1) When the rule operation is "Modify existing QoS rule and add packet filters", "Modify existing QoS rule and replace all packet filters", "Modify existing QoS rule and delete packet filters" or "Modify existing QoS rule without modifying packet filters" on the default QoS rule and the DQR bit is set to "the QoS rule is not the default QoS rule".

2) When the rule operation is "Modify existing QoS rule and add packet filters", "Modify existing QoS rule and replace all packet filters", "Modify existing QoS rule and delete packet filters" or "Modify existing QoS rule without modifying packet filters" on a QoS rule which is not the default QoS rule and the DQR bit is set to "the QoS rule is the default QoS rule".

3) When the rule operation is "Create new QoS rule" and the DQR bit is set to "the QoS rule is the default QoS rule" when there's already a default QoS rule with different QoS rule identifier.

4) When the rule operation is "Delete existing QoS rule" on the default QoS rule.

5) When the rule operation is "Create new QoS rule", "Modify existing QoS rule and add packet filters", "Modify existing QoS rule and replace all packet filters", "Modify existing QoS rule and delete packet filters", or "Modify existing QoS rule without modifying packet filters" and two or more QoS rules associated with this PDU session would have identical precedence values.

6) When the rule operation is "Modify existing QoS rule and delete packet filters", the QoS rule is a QoS rule of a PDU session of IPv4, IPv6, IPv4v6 or Ethernet PDU session type, and the packet filter list in the resultant QoS rule is empty.

7) When the rule operation is "Create new QoS rule", and there is already an existing QoS rule with the same QoS rule identifier and the existing QoS rule is associated with a QoS flow description stored for the EPS bearer context being modified or the existing QoS rule is not associated with any QoS flow description.

8) When the rule operation is "Modify existing QoS rule and add packet filters", "Modify existing QoS rule and replace all packet filters", "Modify existing QoS rule and delete packet filters", or "Modify existing QoS rule without modifying packet filters" and there is no existing QoS rule with the same QoS rule identifier associated with a QoS flow description stored for the EPS bearer context being modified.

9) When the rule operation is "Delete existing QoS rule" and there is no existing QoS rule with the same QoS rule identifier associated with a QoS flow description stored for the EPS bearer context being modified.

10) When the flow description operation is "Create new QoS flow description" and there is already an existing QoS flow description with the same QoS flow identifier stored for the EPS bearer context being modified.

11) When the flow description operation is "Modify existing QoS flow description" and there is no existing QoS flow description with the same QoS flow identifier stored for the EPS bearer context being modified.

12) When the flow description operation is "Delete existing QoS flow description" and there is no existing QoS flow description with the same QoS flow identifier stored for the EPS bearer context being modified.

13) When the UE determines that:

   i) the default EPS bearer context is associated with one or more QoS flows but the default EPS bearer context is not associated with the default QoS rule.

   ii) a dedicated EPS bearer context is associated with one or more QoS flows but the dedicated EPS bearer context is associated with the default QoS rule.

14) When the rule operation is "Create new QoS rule" and there is already an existing QoS rule with the same QoS rule identifier associated with a QoS flow description stored for an EPS bearer context different from the EPS bearer context being modified and belonging to the same PDN connection as the EPS bearer context being modified.

15) When the flow description operation is "Create new QoS flow description", and there is already an existing QoS flow description with the same QoS flow identifier stored for an EPS bearer context different from the EPS bearer context being modified and belonging to the same PDN connection as the EPS bearer context being modified.

16) When the rule operation is "Create new QoS rule", "Modify existing QoS rule and add packet filters", "Modify existing QoS rule and replace all packet filters", "Modify existing QoS rule and delete packet filters", or "Modify existing QoS rule without modifying packet filters" and the resultant QoS rule is associated with a QoS flow description stored for an EPS bearer context different from the EPS bearer context being modified.

17) When the rule operation is "Create new QoS rule", the DQR bit is set to "the QoS rule is not the default QoS rule", the QoS rule is provided for a PDN connection of PDN type "non-IP" and there is locally available information associated with the PDN connection that is set to "Unstructured".

18) When the flow description operation is "Create new QoS flow description" or "Modify existing QoS flow description", the QFI associated with the QoS flow description is not the same as the QFI of the default QoS rule, the QoS flow description is provided for a PDN connection of PDN type "non-IP" and there is locally available information associated with the PDN connection that is set to "Unstructured".

19) When the rule operation is "Modify existing QoS rule and add packet filters", the "packet filter list" field contains a match-all packet filter, the resultant QoS rule is the default QoS rule and there is already an existing match-all packet filter associated with the default QoS rule.

20) When the rule operation is "Create new QoS rule" and the DQR bit is set to "the QoS rule is not the default QoS rule", or the rule operation is "Modify existing QoS rule and add packet filters" on a QoS rule which is not the default QoS rule or "Modify existing QoS rule and replace all packet filters" on a QoS rule which is not the default QoS rule, and one match-all packet filter is to be associated with the resultant QoS rule.

In case 5, if the old QoS rule (i.e. the QoS rule that existed before the MODIFY EPS BEARER CONTEXT REQUEST message was received) is not the default QoS rule and the old QoS rule is associated with a QoS flow description stored for the EPS bearer context being modified, the UE shall not diagnose an error, shall further process the new request and, if it was processed successfully, shall delete the old QoS rule which has identical precedence value. Otherwise, the UE shall include a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause parameter set to 5GSM cause #83 "semantic error in the QoS operation" in the MODIFY EPS BEARER CONTEXT ACCEPT message.

In case 6, if the QoS rule is not the default QoS rule, the UE shall delete the QoS rule. If the QoS rule is the default QoS rule, the UE shall include a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause parameter set to 5GSM cause #83 "semantic error in the QoS operation" in the MODIFY EPS BEARER CONTEXT ACCEPT message.

In case 7, if the existing QoS rule is not the default QoS rule and the DQR bit of the new QoS rule is set to "the QoS rule is not the default QoS rule", the UE shall not diagnose an error, further process the create request and, if it was processed successfully, delete the old QoS rule (i.e. the QoS rule that existed when case 7 was detected). If the existing QoS rule is the default QoS rule or the DQR bit of the new QoS rule is set to "the QoS rule is the default QoS rule", the UE shall include a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause parameter set to 5GSM cause #83 "semantic error in the QoS operation" in the MODIFY EPS BEARER CONTEXT ACCEPT message.

In case 9, the UE shall not diagnose an error, further process the delete request and, if it was processed successfully, consider the respective QoS rule as successfully deleted.

In case 10, the UE shall not diagnose an error, further process the create request and, if it was processed successfully, delete the old QoS flow description (i.e. the QoS flow description that existed when case 10 was detected.

In case 12, the UE shall not diagnose an error, further process the delete request and, if it was processed successfully, consider the respective QoS flow description as successfully deleted.

Otherwise, the UE shall include a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause parameter set to 5GSM cause #83 "semantic error in the QoS operation" in the MODIFY EPS BEARER CONTEXT ACCEPT message.

b) Syntactical errors in QoS operations:

1) When the rule operation is "Create new QoS rule", "Modify existing QoS rule and add packet filters", "Modify existing QoS rule and replace all packet filters" or "Modify existing QoS rule and delete packet filters", the packet filter list in the QoS rule is empty, and the QoS rule is provided for a PDN connection of PDN type IPv4, IPv6, IPv4v6 or Ethernet, or for a PDN connection of PDN type "non-IP" and there is locally available information associated with the PDN connection that is set to "Ethernet".

2) When the rule operation is "Delete existing QoS rule" or "Modify existing QoS rule without modifying packet filters" with a non-empty packet filter list in the QoS rule.

3) When the rule operation is "Modify existing QoS rule and delete packet filters" and the packet filter to be deleted does not exist in the original QoS rule.

4) Void.

5) When there are other types of syntactical errors in the coding of the QoS rules parameter, the QoS rules with the length of two octets parameter, the QoS flow descriptions parameter or the QoS flow descriptions with the length of two octets parameter, such as a mismatch between the number of packet filters subfield, and the number of packet filters in the packet filter list when the rule operation is "delete existing QoS rule" or "create new QoS rule", or the number of packet filters subfield is larger than the maximum possible number of packet filters in the packet filter list (i.e., there is no QoS rule precedence subfield included in the QoS rule IE), the QoS Rule Identifier is set to "no QoS rule identifier assigned" when the rule operation is not "delete existing QoS rule", or the QoS flow identifier is set to "no QoS flow identifier assigned" when the flow description operation is not "Delete existing QoS flow description".

6) When, the

A) rule operation is "Create new QoS rule", "Modify existing QoS rule and add packet filters", "Modify existing QoS rule and replace all packet filters", "Modify existing QoS rule and delete packet filters" or "Modify existing QoS rule without modifying packet filters", the UE determines, by using the QoS rule's QFI as the 5QI, that there is a resulting QoS rule for a GBR QoS flow (as described in 3GPP TS 23.501 [8] table 5.7.4-1), and there is no QoS flow description with a QFI corresponding to the QFI of the resulting QoS rule.

B) flow description operation is "Delete existing QoS flow description", and the UE determines, by using the QoS rule's QFI as the 5QI, that there is a resulting QoS rule for a GBR QoS flow (as described in 3GPP TS 23.501 [8] table 5.7.4-1) with a QFI corresponding to the QFI of the QoS flow description that is deleted (i.e. there is no associated QoS flow description with the same QFI).

7) When the flow description operation is "Create new QoS flow description" or "Modify existing QoS flow description", and the UE determines that there is a QoS flow description of a GBR QoS flow (as described in 3GPP TS 23.501 [8] table 5.7.4-1) which lacks at least one of the mandatory parameters (i.e., GFBR uplink,

GFBR downlink, MFBR uplink and MFBR downlink). If the QoS flow description does not include a 5QI, the UE determines this by using the QFI as the 5QI.

8) When the rule operation is "Create new QoS rule", "Modify existing QoS rule and add packet filters" or "Modify existing QoS rule and replace all packet filters" with a non-empty packet filter list in the QoS rule, and the DQR bit is set to "the QoS rule is the default QoS rule", the QoS rule is provided for a PDN connection of PDN type "non-IP" and there is locally available information associated with the PDN connection that is set to "Unstructured".

In case 3 the UE shall not diagnose an error, further process the deletion request and, if no error according to items c and d was detected, consider the respective packet filter as successfully deleted.

Otherwise the UE shall include a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause parameter set to 5GSM cause #84 "syntactical error in the QoS operation" in the MODIFY EPS BEARER CONTEXT ACCEPT message.

NOTE 3: It is not considered an error if the UE determines that after processing all QoS operations on QoS rules and QoS flow descriptions there is a QoS flow description that is not associated with any QoS rule and the UE is not in NB-N1 mode.

NOTE 3a: An implementation that strictly follows QoS rule operation as defined in subclause 9.11.4.13 might not detect case 2).

c) Semantic errors in packet filters:

1) When a packet filter consists of conflicting packet filter components which would render the packet filter ineffective, i.e. no IP packet will ever fit this packet filter. How the UE determines a semantic error in a packet filter is outside the scope of the present document.

The UE shall include a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause parameter set to 5GSM cause #44 "semantic errors in packet filter(s)" in the MODIFY EPS BEARER CONTEXT ACCEPT message.

d) Syntactical errors in packet filters:

1) When the rule operation is "Modify existing QoS rule and add packet filters" or "Modify existing QoS rule and replace all packet filters", and two or more packet filters in the resultant QoS rule would have identical packet filter identifiers.

2) When the rule operation is "Create new QoS rule", and two or more packet filters in the resultant QoS rule would have identical packet filter identifiers.

3) When there are other types of syntactical errors in the coding of packet filters, such as the use of a reserved value for a packet filter component identifier.

4) Void.

In case 1, if two or more packet filters with identical packet filter identifiers are contained in the MODIFY EPS BEARER CONTEXT REQUEST message, the UE shall include a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause parameter set to 5GSM cause #45 "syntactical error in packet filter(s)" in the MODIFY EPS BEARER CONTEXT ACCEPT message. Otherwise, the UE shall not diagnose an error, further process the MODIFY EPS BEARER CONTEXT REQUEST message and, if it was processed successfully, delete the old packet filters which have the identical packet filter identifiers.

Otherwise the UE shall include a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause parameter set to 5GSM cause #45 "syntactical error in packet filter(s)" in the MODIFY EPS BEARER CONTEXT ACCEPT message.

If the UE detects different errors in the QoS rules and QoS flow descriptions as described in this subclause which requires sending a 5GSM cause parameter in the MODIFY EPS BEARER CONTEXT ACCEPT message, the UE shall include a single 5GSM cause parameter in the MODIFY EPS BEARER CONTEXT ACCEPT message.

NOTE 4: The 5GSM cause to use cannot be different from #44 "semantic error in packet filter(s)", #45 "syntactical errors in packet filter(s)", #83 "semantic error in the QoS operation" or #84 "syntactical error in the QoS operation". The selection of a 5GSM cause is up to UE implementation.

Upon successful completion of an EPS attach procedure or tracking area updating procedure after inter-system change from N1 mode to S1 mode (see 3GPP TS 24.301 [15]), unless the PDU session is an MA PDU session established over 3GPP access and over non-3GPP access both connected to 5GCN,

a) the UE shall delete any UE derived QoS rules of each PDU session which has been transferred to EPS;

b) the UE and the SMF shall perform a local release of the PDU session(s) associated with 3GPP access which have not been transferred to EPS; and

c) the UE and the SMF shall perform a local release of QoS flow(s) which have not been transferred to EPS, of the PDU session(s) which have been transferred to EPS. The UE and the SMF shall also perform a local release of any QoS flow description not associated with any QoS rule and not associated with any mapped EPS bearer context. If there is a QoS flow description not associated with any QoS rule, but associated with a mapped EPS bearer context, and after the inter-system change from N1 mode to S1 mode the respective EPS bearer context is active, then the UE shall associate the QoS flow description with the EPS bearer context.

For PDU session(s) associated with non-3GPP access in 5GS, if present, the UE may:

a) keep some or all of these PDU sessions still associated with non-3GPP access in 5GS, if supported;

b) release some or all of these PDU sessions explicitly by initiating the UE requested PDU session release procedure(s); or

c) attempt to transfer some or all of these PDU sessions from N1 mode to S1 mode by initiating the UE requested PDN connectivity procedure(s) with the PDN CONNECTIVITY REQUEST message created as follows:

   1) if the PDU session is an emergency PDU session, the request type shall be set to "handover of emergency bearer services". Otherwise the request type shall be set to "handover";

   2) the PDU session type of the PDU session shall be mapped to the PDN type of the default EPS bearer context as follows:

      i) the PDN type shall be set to "non-IP" if the PDU session type is "Unstructured";

      ii) the PDN type shall be set to "IPv4" if the PDU session type is "IPv4";

      iii) the PDN type shall be set to "IPv6" if the PDU session type is "IPv6";

      iv) the PDN type shall be set to "IPv4v6" if the PDU session type is "IPv4v6";

      v) the PDN type shall be set to "non-IP" if the PDU session type is "Ethernet" and the UE, the network or both of them do not support Ethernet PDN type in S1 mode; and

      vi) the PDN type shall be set to "Ethernet" if the PDU session type is "Ethernet" and the UE and the network support Ethernet PDN type in S1 mode;

   3) the DNN of the PDU session shall be mapped to the APN of the default EPS bearer context, unless the PDN connection is an emergency PDN connection; and

   4) the PDU session ID parameter in the Protocol configuration options IE or the Extended protocol configuration options IE shall be set to the PDU session identity of the PDU session.

   If a PDU session associated with non-3GPP access is transferred to EPS, the UE shall associate the PDU session identity with the default EPS bearer context and shall delete any UE derived QoS rules of such PDU session.

Interworking to 5GS is supported for a PDN connection, if the corresponding default EPS bearer context includes a PDU session identity, an S-NSSAI, if the PDN connection is a non-emergency PDN connection, session AMBR and one or more QoS flow descriptions received in the Protocol configuration options IE or Extended protocol configuration options IE (see 3GPP TS 24.301 [15]), or the default EPS bearer context has association with the PDU session identity, the S-NSSAI, if the PDU session is a non-emergency PDU session, the session-AMBR and one or more QoS flow descriptions after inter-system change from N1 mode to S1 mode.

For a PDN connection established in S1 mode, to enable the UE to attempt to transfer the PDN connection from S1 mode to N1 mode in case of inter-system change, the UE shall allocate a PDU session identity, indicate the allocated PDU session identity in the PDU session ID parameter in the Protocol configuration options IE of the PDN CONNECTIVITY REQUEST message and associate the allocated PDU session identity with the default EPS bearer

context of the PDN connection. If an N5CW device supporting 3GPP access establishes a new PDN connection in S1 mode, the N5CW device supporting 3GPP access shall refrain from allocating "PDU session identity value 15".

For a PDN connection established in S1 mode, the SMF assigning the QoS rules shall consider that the UE supports 16 packet filters for the corresponding PDU session until the UE indicates a higher number (as specified in subclause 6.4.2.2).

The network may provide the UE with one or more QoS rules by including either one QoS rules parameter, or one QoS rules with the length of two octets parameter, but not both, in the Protocol configuration options IE or Extended protocol configuration options IE in the ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST or ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message. The network may provide the UE with one or more QoS flow descriptions corresponding to the EPS bearer context being activated, by including either one QoS flow descriptions parameter, or one QoS flow descriptions with the length of two octets parameter, but not both, in the Protocol configuration options IE or Extended protocol configuration options IE in the ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST or ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message.

When the UE is provided with one or more QoS flow descriptions in the Protocol configuration options IE or Extended protocol configuration options IE of the ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST or ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message, the UE shall check the EPS bearer identity included in the QoS flow description; and:

a) if the EPS bearer identity corresponds to the EPS bearer context being activated or the EPS bearer identity is not included, the UE shall store the QoS flow description and all the associated QoS rules, if any, for the EPS bearer context being activated for use during inter-system change from S1 mode to N1 mode; and

b) otherwise the UE shall locally delete the QoS flow description and all the associated QoS rules, if any, and include a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause parameter set to 5GSM cause #84 "syntactical error in the QoS operation" in the ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT or ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.

When the UE is provided with one or more QoS rules, or one or more QoS flow descriptions in the Protocol configuration options IE or Extended protocol configuration options IE of the ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST or ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message, the UE shall process the QoS rules sequentially starting with the first QoS rule and shall process the QoS flow descriptions sequentially starting with the first QoS flow description. The UE shall check QoS rules and QoS flow descriptions for different types of errors as follows:

NOTE 5: If an error is detected in a QoS rule or a QoS flow description which requires sending a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause value, then the QoS rules parameter, the QoS rules with the length of two octets parameter, the QoS flow descriptions parameter and the QoS flow descriptions with the length of two octets parameter included in the Protocol configuration options IE or Extended protocol configuration options IE in the ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST or ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message are discarded, if any.

NOTE 6: If the default EPS bearer context activation procedure or the dedicated EPS bearer context activation procedure is rejected, then the QoS rules parameter, the QoS rules with the length of two octets parameter, the QoS flow descriptions parameter and the QoS flow descriptions with the length of two octets parameter included in the Protocol configuration options IE or Extended protocol configuration options IE in the ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST or ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message are discarded, if any.

a) Semantic errors in QoS operations:

   1) When the rule operation is "Create new QoS rule" and the DQR bit is set to "the QoS rule is the default QoS rule" when there's already a default QoS rule.

   2) When the rule operation is received in an ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST message, the rule operation is "Create new QoS rule", and there is no rule with the DQR bit set to "the QoS rule is the default QoS rule".

   3) When the rule operation is "Create new QoS rule" and two or more QoS rules associated with this PDU session would have identical precedence values.

4) When the rule operation is an operation other than "Create new QoS rule".

5) When the flow description operation is an operation other than "Create new QoS flow description".

6) When the UE determines that:

   i) the default EPS bearer context is associated with one or more QoS flows but the default EPS bearer context is not associated with the default QoS rules.

   ii) a dedicated EPS bearer context is associated with one or more QoS flows but the dedicated EPS bearer context is associated with the default QoS rule.

7) When the flow description operation is received in an ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message, the flow description operation is "Create new QoS flow description" and there is already an existing QoS flow description with the same QoS flow identifier stored for an EPS bearer context different from the EPS bearer context being activated and belonging to the same PDN connection as the EPS bearer context being activated.

8) When the rule operation is received in an ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message, the rule operation is "Create new QoS rule" and there is already an existing QoS rule with the same QoS rule identifier stored for an EPS bearer context different from the EPS bearer context being activated and belonging to the same PDN connection as the EPS bearer context being activated.

9) When the rule operation is received in an ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST message, the rule operation is "Create new QoS rule" and the resultant QoS rule is associated with a QoS flow description stored for an EPS bearer context different from the EPS bearer context being activated and belonging to the same PDN connection as the EPS bearer context being activated.

10) When the rule operation is "Create new QoS rule" and the DQR bit is set to "the QoS rule is not the default QoS rule" and one match-all packet filter is to be associated with the QoS rule.

11) When the flow description operation is "Create new QoS flow description" and there is already an existing QoS flow description with the same QoS flow identifier stored for the EPS bearer context being activated.

12) When the rule operation is "Create new QoS rule", and there is already an existing QoS rule with the same QoS rule identifier and the existing QoS rule is associated with a QoS flow description stored for the EPS bearer context being activated or the existing QoS rule is not associated with any QoS flow description.

In case 4, if the rule operation is for a non-default QoS rule, the UE shall delete the QoS rule. If the QoS rule is the default QoS rule, the UE shall include a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause parameter set to 5GSM cause #83 "semantic error in the QoS operation" in the ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT or ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.

In case 11, the UE shall not diagnose an error, further process the create request and, if it was processed successfully, delete the old QoS flow description (i.e. the QoS flow description that existed when case 11 was detected).

In case 12, if the existing QoS rule is not the default QoS rule and the DQR bit of the new QoS rule is set to "the QoS rule is not the default QoS rule", the UE shall not diagnose an error, further process the create request and, if it was processed successfully, delete the old QoS rule (i.e. the QoS rule that existed when case 12 was detected). If the existing QoS rule is the default QoS rule or the DQR bit of the new QoS rule is set to "the QoS rule is the default QoS rule", the UE shall include a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause parameter set to 5GSM cause #83 "semantic error in the QoS operation" in the ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT or ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.

Otherwise for all the cases above, the UE shall include a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause parameter set to 5GSM cause #83 "semantic error in the QoS operation" in the ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT or ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.

b) Syntactical errors in QoS operations:

1) When the rule operation is "Create new QoS rule", the packet filter list in the QoS rule is empty, and the QoS rule is provided for a PDN connection of PDN type IPv4, IPv6, IPv4v6 or Ethernet, or for a PDN connection of PDN type "non-IP" and there is locally available information associated with the PDN connection that is set to "Ethernet".

2) Void.

3) When there are other types of syntactical errors in the coding of the QoS rules parameter, the QoS rules with the length of two octets parameter, the QoS flow descriptions parameter or the QoS flow descriptions with the length of two octets parameter, such as a mismatch between the number of packet filters subfield, and the number of packet filters in the packet filter list when the rule operation is "delete existing QoS rule" or "create new QoS rule", or the number of packet filters subfield is larger than the maximum possible number of packet filters in the packet filter list (i.e., there is no QoS rule precedence subfield included in the QoS rule IE), the QoS Rule Identifier is set to "no QoS rule identifier assigned", or the QoS flow identifier is set to "no QoS flow identifier assigned.

4) When, the

   A) rule operation is "Create new QoS rule", the UE determines, by using the QoS rule's QFI as the 5QI, that there is a resulting QoS rule for a GBR QoS flow (as described in 3GPP TS 23.501 [8] table 5.7.4-1), and there is no QoS flow description with a QFI corresponding to the QFI of the resulting QoS rule.

5) When the flow description operation is "Create new QoS flow description", and the UE determines that there is a QoS flow description of a GBR QoS flow (as described in 3GPP TS 23.501 [8] table 5.7.4-1) which lacks at least one of the mandatory parameters (i.e., GFBR uplink, GFBR downlink, MFBR uplink and MFBR downlink). If the QoS flow description does not include a 5QI, the UE determines this by using the QFI as the 5QI.

The UE shall include a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause parameter set to 5GSM cause #84 "syntactical error in the QoS operation" in the ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT or ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.

NOTE 7: It is not considered an error if the UE determines that after processing all QoS operations on QoS rules and QoS flow descriptions there is a QoS flow description that is not associated with any QoS rule and the UE is not in NB-N1 mode.

c) Semantic errors in packet filters:

1) When a packet filter consists of conflicting packet filter components which would render the packet filter ineffective, i.e. no IP packet will ever fit this packet filter. How the UE determines a semantic error in a packet filter is outside the scope of the present document.

The UE shall include a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause parameter set to 5GSM cause #44 "semantic errors in packet filter(s)" in the ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT or ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.

d) Syntactical errors in packet filters:

1) When the rule operation is "Create new QoS rule" and two or more packet filters in the resultant QoS rule would have identical packet filter identifiers.

2) When there are other types of syntactical errors in the coding of packet filters, such as the use of a reserved value for a packet filter component identifier.

The UE shall delete the QoS rule and include a Protocol configuration options IE or Extended protocol configuration options IE with a 5GSM cause parameter set to 5GSM cause #45 "syntactical error in packet filter(s)" in the ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT or ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.

If the UE detects different errors in the QoS rules and QoS flow descriptions as described in this subclause which requires sending a 5GSM cause parameter in the ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT or ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message, the UE shall include a single 5GSM cause

parameter in the ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT or ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT message.

NOTE 8: The 5GSM cause to use cannot be different from #44 "semantic error in packet filter(s)", #45 "syntactical errors in packet filter(s)", #83 "semantic error in the QoS operation" or #84 "syntactical error in the QoS operation". The selection of a 5GSM cause is up to UE implementation.

Upon inter-system change from S1 mode to N1 mode, the UE uses the parameters from the default EPS bearer context of each PDN connection for which interworking to 5GS is supported to create a corresponding PDU session associated with 3GPP access as follows, unless the PDN connection is a user-plane resource of an MA PDU session:

a) the PDN type of the default EPS bearer context shall be mapped to the PDU session type of the PDU session as follows:

   1) if the PDN type is "non-IP":

      - the PDU session type is set to the locally available information associated with the PDN connection (either "Ethernet" or "Unstructured"), if available; or

      - otherwise, the PDU session type is set to "Unstructured";

   2) if the PDN type is "IPv4" the PDU session type is set to "IPv4";

   3) if the PDN type is "IPv6", the PDU session type is set to "IPv6";

   4) if the PDN type is "IPv4v6", the PDU session type is set to "IPv4v6"; and

   5) if the PDN type is "Ethernet", the PDU session type is "Ethernet";

b) the PDN address of the default EPS bearer context shall be mapped to PDU address of the PDU session, if the PDN type is "IPv4", "IPv6" or "IPv4v6";

c) the APN of the default EPS bearer context shall be mapped to the DNN of the PDU session, unless the PDN connection is an emergency PDN connection;

d) for each default EPS bearer context in state BEARER CONTEXT ACTIVE the UE shall set the state of the mapped PDU session to PDU SESSION ACTIVE; and

e) for any other default EPS bearer context the UE shall set the state of the mapped PDU session to PDU SESSION INACTIVE.

Additionally, the UE shall set:

a) the PDU session identity of the PDU session to the PDU session identity included by the UE in the Protocol configuration options IE or Extended protocol configuration options IE in the PDN CONNECTIVITY REQUEST message, or the PDU session identity associated with the default EPS bearer context;

b) the S-NSSAI of the PDU session to the S-NSSAI included by the network in the Protocol configuration options IE or Extended protocol configuration options IE in the ACTIVATE DEFAULT EPS BEARER REQUEST message, or the S-NSSAI associated with the default EPS bearer context, if the PDN connection is a non-emergency PDN connection;

c) the session-AMBR of the PDU session to the session-AMBR included by the network in the Protocol configuration options IE or Extended protocol configuration options IE in the ACTIVATE DEFAULT EPS BEARER REQUEST message or the MODIFY EPS BEARER CONTEXT REQUEST message, or the session-AMBR associated with the default EPS bearer context;

d) the SSC mode of the PDU session to "SSC mode 1"; and

e) the always-on PDU session indication to the always-on PDU session indication maintained in the UE, if any.

Upon inter-system change from S1 mode to N1 mode, the UE shall locally release the PDN connection(s) for which interworking to 5GS is not supported.

Upon inter-system change from S1 mode to N1 mode, for each PDN connection which is a user-plane resource of MA PDU session and for which interworking to 5GS is supported, the UE shall consider that the MA PDU session is

established over 3GPP access and, unless the MA PDU session is established over non-3GPP access too, the UE shall set the session-AMBR of the PDU session to the session-AMBR included by the network in the Protocol configuration options IE or Extended protocol configuration options IE in the ACTIVATE DEFAULT EPS BEARER REQUEST message or the MODIFY EPS BEARER CONTEXT REQUEST message, or the session-AMBR associated with the default EPS bearer context of the PDN connection.

Upon inter-system change from S1 mode to N1 mode, if:

a) the UE sent the URSP provisioning in EPS support indicator and received the URSP provisioning in EPS support indicator in the PDN connection corresponding to the PDU session; or

b) the default EPS bearer context of the PDN connection corresponding to the PDU session is associated with the URSP provisioning in EPS support indicators;

then the UE shall associate the PDU session with the URSP provisioning in EPS support indicators.

Additionally, for each EPS bearer context of the PDN connection, the UE shall create QoS flow(s) each of which is associated with the QoS flow description received in the Protocol configuration options IE or Extended protocol configuration options IE in the ACTIVATE DEFAULT EPS BEARER REQUEST message, ACTIVATE DEDICATED EPS BEARER REQUEST message, or MODIFY EPS BEARER REQUEST message (see 3GPP TS 24.301 [15]), or the QoS flow description associated with EPS bearer context, unless:

a) the PDU session is an MA PDU session which:

   1) is established over non-3GPP access; and

   2) has a PDN connection as a user-plane resource; and

b) the QoS flow already exists over the non-3GPP access.

Additionally, for each EPS bearer context of the PDN connection, the UE shall create QoS rules(s), if any, each of which is associated with the QoS rule received in the Protocol configuration options IE or Extended protocol configuration options IE in the ACTIVATE DEFAULT EPS BEARER REQUEST message, ACTIVATE DEDICATED EPS BEARER REQUEST message, or MODIFY EPS BEARER CONTEXT REQUEST message (see 3GPP TS 24.301 [15]), or the QoS rules associated with EPS bearer context, unless:

a) the PDU session is an MA PDU session which:

   1) is established over non-3GPP access; and

   2) has a PDN connection as a user-plane resource; and

b) the QoS rule already exists over the non-3GPP access.

NOTE 9: For a QoS rule which does not exist over non-3GPP access, the UE does not create the QoS rule if the QoS rule is the default QoS rule, or the precedence value of the QoS rule equals to the precedence value of a QoS rule exists over the non-3GPP access.

Additionally, for each PDU session which was created at inter-system change from S1 mode to N1 mode from a corresponding PDN connection of the "Ethernet" PDN type, the UE shall consider that Ethernet PDN type in S1 mode is supported by the network and the SMF shall consider that Ethernet PDN type in S1 mode is supported by the UE.

The UE and the network shall locally release the PDN connection(s) and EPS bearer context(s) associated with the 3GPP access which have not been transferred to 5GS.

After inter-system change from S1 mode to N1 mode, for each QoS flow mapped from an EPS bearer context the UE shall associate the EPS bearer identity, the EPS QoS parameters, the extended EPS QoS parameters, and the traffic flow template, if available, of the EPS bearer context with the QoS flow.

After inter-system change from S1 mode to N1 mode, for each QoS flow of an MA PDU session which:

a) is established over non-3GPP access; and

b) has a PDN connection as a user-plane resource;

such that the QoS flow was received in the Protocol configuration options IE or Extended protocol configuration options IE in the ACTIVATE DEFAULT EPS BEARER REQUEST message, ACTIVATE DEDICATED EPS BEARER REQUEST message, MODIFY EPS BEARER CONTEXT REQUEST message, (see 3GPP TS 24.301 [15]), or associated with EPS bearer context, the UE shall associate the EPS bearer identity, the EPS QoS parameters, the extended EPS QoS parameters, and the traffic flow template, if available, of the EPS bearer context with the QoS flow.

If the EPS bearer context(s) of the PDN connection are associated with the control plane only indication, and the PDN connection supports interworking to 5GS, after inter-system change from S1 mode to N1 mode, the UE shall associate the PDU session corresponding to the PDN connection with the control plane only indication.

If the default EPS bearer context of the PDN connection is associated with the PDU session pair ID, and the PDN connection supports interworking to 5GS, after inter-system change from S1 mode to N1 mode, the UE shall associate the PDU session corresponding to the PDN connection with the PDU session pair ID. If the default EPS bearer context of the PDN connection is associated with the RSN, and the PDN connection supports interworking to 5GS, after inter-system change from S1 mode to N1 mode, the UE shall associate the PDU session corresponding to the PDN connection with the RSN.

If there is an EPS bearer used for IMS signalling, after inter-system change from S1 mode to N1 mode, the QoS flow of the default QoS rule in the corresponding PDU session is used for IMS signalling.

For a PDN connection established when in S1 mode, upon an inter-system change from S1 mode to N1 mode, if a UE-requested PDU session modification procedure has not been successfully performed yet,the SMF shall determine the always-on PDU session indication as specified in subclause 6.3.2.2.

When the UE is provided with one or more mapped EPS bearer contexts in the Mapped EPS bearer contexts IE of the PDU SESSION MODIFICATION COMMAND message, the UE shall process the mapped EPS bearer contexts sequentially starting with the first mapped EPS bearer context.

When the UE is provided with a new EPS bearer identity, a new EPS QoS parameters, a new extended EPS QoS parameters, a new APN-AMBR or a new extended APN-AMBR in the Mapped EPS bearer context IE of the PDU SESSION MODIFICATION COMMAND message for a QoS flow, the UE shall discard the corresponding association(s) and associate the new value(s) with the QoS flow.

When the UE is provided with a new traffic flow template in the Mapped EPS bearer contexts IE of the PDU SESSION MODIFICATION COMMAND message for a QoS flow, the UE shall check the traffic flow template for different types of TFT IE errors as specified in subclause 6.3.2.3.

When a QoS flow is deleted, the associated EPS bearer context information that are mapped from the deleted QoS flow shall be deleted from the UE and the network if there is no other existing QoS flow associated with this EPS bearer context. When the EPS bearer identity of a QoS flow is deleted, the associated EPS bearer context information that are mapped from the deleted EPS bearer identity shall be deleted from the UE and the network if there is no other existing QoS flow associated with this EPS bearer context. When an EPS bearer is released, all the associated QoS flow descriptions and QoS rules that are mapped from the released EPS bearer shall be deleted from the UE and the network.

NOTE 10: If T3584 is running or deactivated for the S-NSSAI and optionally the DNN combination, the UE is allowed to initate ESM procedures in EPS with or without APN corresponding to that DNN, and if the APN is congested in EPS, the MME can send a back-off timer for the APN to the UE as specified in 3GPP TS 24.301 [15].

Upon inter-system change from N1 mode to S1 mode, if the UE has any PDU sessions associated with one or more multicast MBS sessions, the UE shall locally leave the associated multicast MBS sessions and the network shall consider the UE as removed from the associated MBS sessions.

For the case of handover of an existing PDU session from 3GPP access to non-3GPP access,

- upon receipt of the PDU SESSION ESTABLISHMENT ACCEPT message, the UE locally deletes the EPS bearer identities for the PDU session, if any (see subclause 6.4.1.3); and

- after successful handover, the network shall locally delete the EPS bearer identities for the PDU session, if any.

6.1.4.2 Coordination between 5GSM and ESM without N26 interface

When the network does not support N26 interface, the SMF does not provide the UE with the mapped EPS bearer context for a PDU session.

NOTE 1: Since the SMF does not provide the UE with the mapped EPS bearer context for a PDU session, the UE does not know whether interworking with EPS is supported for a PDU session before attempting to transfer the PDU session from N1 mode to S1 mode.

NOTE 2: It is up to UE implementation to decide which PDU session(s) to be attempted to transfer from N1 mode to S1 mode, e.g. based on UE policy or UE local configuration.

Upon inter-system change from N1 mode to S1 mode in EMM-IDLE mode, the UE shall not transfer a PDU session for LADN to EPS.

Upon inter-system change from N1 mode to S1 mode in EMM-IDLE mode, the UE shall not transfer a multi-homed IPv6 PDU session to EPS.

Upon inter-system change from N1 mode to S1 mode in EMM-IDLE mode, the UE shall not transfer a PDU session with the selected SSC mode set to "SSC mode 2" or "SSC mode 3" to EPS.

Upon inter-system change from N1 mode to S1 mode in EMM-IDLE mode, the UE shall use the parameters from each PDU session which the UE intends to transfer to EPS to create the contents of a PDN CONNECTIVITY REQUEST message as follows:

a) if the PDU session is an emergency PDU session, the request type shall be set to "handover of emergency bearer services". Otherwise the request type shall be set to "handover";

b) the PDU session type of the PDU session shall be mapped to the PDN type of the default EPS bearer context as follows:

   1) the PDN type shall be set to "non-IP" if the PDU session type is "Unstructured";

   2) the PDN type shall be set to "IPv4" if the PDU session type is "IPv4";

   3) the PDN type shall be set to "IPv6" if the PDU session type is "IPv6";

   4) the PDN type shall be set to "IPv4v6" if the PDU session type is "IPv4v6";

   5) the PDN type shall be set to "non-IP" if the PDU session type is "Ethernet" and the UE, the network or both of them do not support Ethernet PDN type in S1 mode; and

   6) the PDN type shall be set to "Ethernet" if the PDU session type is "Ethernet" and the UE and the network support Ethernet PDN type in S1 mode;

c) the DNN of the PDU session shall be mapped to the APN of the default EPS bearer context, unless the PDU session is an emergency PDU session;

d) the PDU session ID parameter in the Protocol configuration options IE or Extended protocol configuration options IE shall be set to the PDU session identity of the PDU session; and

e) if the PDU session is an MA PDU session established over 3GPP access, the ATSSS request parameter shall be included in the Protocol configuration options IE or Extended protocol configuration options IE.

After inter-system change from N1 mode to S1 mode, the UE shall associate the PDU session identity with the default EPS bearer context. If the PDU session being transferred is a non-emergency PDU session, the UE shall in addition associate the S-NSSAI and the PLMN ID of the current PLMN with the default EPS bearer context.

Upon successful completion of an EPS attach procedure after inter-system change from N1 mode to S1 mode (see 3GPP TS 24.301 [15]), the UE shall delete any UE derived QoS rules except when the PDU session is an MA PDU session established over 3GPP access and non-3GPP access both connected to the 5GCN.

The UE shall perform a local release of the PDU session(s) and QoS flow(s) associated with the 3GPP access which have not been transferred to EPS. The UE shall also perform a local release of any QoS flow description not associated with any QoS rule.

For PDU session(s) associated with non-3GPP access in 5GS, if present, the UE may:

a) keep some or all of these PDU sessions still associated with non-3GPP access in 5GS, if supported;

b) release some or all of these PDU sessions explicitly by initiating the UE requested PDU session release procedure(s); or

c) attempt to transfer some or all of these PDU sessions from N1 mode to S1 mode by initiating the UE requested PDN connectivity procedure(s) with the PDN CONNECTIVITY REQUEST message created as above.

When the network does not support N26 interface, the MME does not provide the UE with the mapped PDU session for a PDN connection but provides the UE with an S-NSSAI if the PDN connection is not for emergency bearer services. When establishing a new PDN connection in S1 mode, to enable the UE to attempt to transfer the PDN connection from S1 mode to N1 mode in case of inter-system change, the UE shall allocate a PDU session identity, indicate the allocated PDU session identity in the PDU session ID parameter in the Protocol configuration options IE of the PDN CONNECTIVITY REQUEST message and associate the allocated PDU session identity with the default EPS bearer context of the PDN connection. If an N5CW device supporting 3GPP access establishes a new PDN connection in S1 mode, the N5CW device supporting 3GPP access shall refrain from allocating "PDU session identity value 15". The network provides the UE with an S-NSSAI and the related PLMN ID in the Protocol configuration options IE or Extended protocol configuration options IE of the ACTIVATE DEFAULT EPS BEARER REQUEST message, the UE shall delete the stored S-NSSAI and the related PLMN ID, if any, and shall store the S-NSSAI and the related PLMN ID provided in the ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST message.

NOTE 3: Since the MME does not provide the UE with the mapped PDU session for a PDN connection, the UE does not know whether interworking to 5GS is supported for a PDN connection for which the UE assigned a PDU Session identity before attempting to transfer the PDN connection from S1 mode to N1 mode.

NOTE 4: It is up to UE implementation to decide which PDN connection(s) to be attempted to transfer from S1 mode to N1 mode, e.g. based on UE policy or UE local configuration.

NOTE 5: If the PDN connection has been transferred from a PDN connection established via non-3GPP access to EPC, it is possible that the network provided the S-NSSAI already during the establishment via non-3GPP access (see 3GPP TS 24.302 [16]).

Upon inter-system change from S1 mode to N1 mode in 5GMM-IDLE mode, the UE uses the parameters from the default EPS bearer context of each PDN connection which the UE intends to transfer to 5GS and for which the UE has allocated a PDU session identity to create a PDU SESSION ESTABLISHMENT REQUEST message as follows:

a) if the PDN connection is for emergency bearer services, the request type shall be set to "existing emergency PDU session". Otherwise the request type shall be set to:

   1) "MA PDU request", if the PDN connection to be transferred is a user-plane resource of an MA PDU session; or

   2) "existing PDU session";

b) the PDN type of the default EPS bearer context shall be mapped to the PDU session type of the PDU session as follows:

   1) if the PDN type is "non-IP":

      - the PDU session type is set to the locally available information associated with the PDN connection (either "Ethernet" or "Unstructured"), if available; or

      - otherwise, the PDU session type is set to "Unstructured";

   2) if the PDN type is "IPv4" the PDU session type is set to "IPv4";

   3) if the PDN type is "IPv6", the PDU session type is set to "IPv6";

   4) if the PDN type is "IPv4v6", the PDU session type is set to "IPv4v6"; and

   5) if the PDN type is "Ethernet", the PDU session type is set to "Ethernet"; and

c) the APN of the default EPS bearer context shall be mapped to the DNN of the PDU session, unless the PDN connection is an emergency PDN connection;

d) the PDU session ID shall be set to the PDU session identity included by the UE in the Protocol configuration options IE or Extended protocol configuration options IE in the PDN CONNECTIVITY REQUEST message, or to the PDU session ID associated with the default EPS bearer context;

e) if the PDU session is not an emergency PDU session, the S-NSSAI of the PDU session shall be set to the S-NSSAI included by the network in the Protocol configuration options IE or Extended protocol configuration options IE in the ACTIVATE DEFAULT EPS BEARER REQUEST message, if provided by the network, or the S-NSSAI associated with the default EPS bearer context, if available; and

f) the SSC mode IE shall be set to "SSC mode 1".

NOTE 6: If T3584 is running or deactivated for the S-NSSAI and optionally the DNN combination, the UE is allowed to initiate ESM procedures in EPS with or without APN corresponding to that DNN, and if the APN is congested in EPS, the MME can send a back-off timer for the APN to the UE as specified in 3GPP TS 24.301 [15].

The UE shall locally release the PDN connection(s) and EPS bearer(s) associated with the 3GPP access which have not been transferred to 5GS.

Upon inter-system change from N1 mode to S1 mode, if the UE has any PDU sessions associated with one or more MBS multicast sessions, the UE shall locally leave the associated multicast MBS sessions and the network shall consider the UE as removed from the associated multicast MBS sessions.

Upon inter-system change from S1 mode to N1 mode, for the PDN connection(s) in the EPS transferred to the 5GS, if the UE supports reporting of URSP rule enforcement and is indicated to send URSP rule enforcement report to the network based on the matching URSP rule newly enforced while the UE was in S1 mode, which contains the URSP rule enforcement report indication set to "URSP rule enforcement report is required", the UE shall include the URSP rule enforcement reports IE in the PDU SESSION ESTABLISHMENT REQUEST message.

6.1.4a Coordination between 5GSM and SM

Coordination between 5GSM and SM states is not required.

After the 5G-SRVCC handover from NG-RAN to UTRAN (see 3GPP TS 23.216 [6A]), all the PDU sessions of the UE are locally released at the UE and the network. If the UE has any PDU sessions associated with one or more MBS multicast sessions, the UE shall locally leave the associated MBS multicast sessions and the network shall consider the UE as removed from the associated MBS sessions.

6.1.5 Coordination for interworking with ePDG connected to EPC

When the UE establishes a new PDN connection via an ePDG connected to EPC, to enable the transfer of the PDN connection to N1 mode over 3GPP access in case of inter-system change, the UE allocates a PDU session identity and indicates its value in the PDU session ID field in the N1_MODE_CAPABILITY Notify payload of the IKE_AUTH request message (see 3GPP TS 24.302 [16]). The network provides the UE with an S-NSSAI in the N1_MODE_INFORMATION Notify payload of the IKE_AUTH response message (see 3GPP TS 24.302 [16]).

NOTE: Interworking between N1 mode over non-3GPP access and ePDG connected to EPC is not specified in this release of the specification.

Upon inter-system change to N1 mode over 3GPP access, for PDN connection(s) established via an ePDG connected to EPC, if present, the UE may:

a) keep some or all of these PDN connections still via ePDG connected to EPC, if supported;

b) release some or all of these PDN connections explicitly by initiating the UE initiated tunnel disconnection procedure(s) as specified in 3GPP TS 24.302 [16]; or

c) attempt to transfer some or all of these PDN connections to N1 mode over 3GPP access using the parameters of the PDN connection for which the UE has allocated a PDU session identity by initiating the PDU session establishment procedure(s) with the PDU SESSION ESTABLISHMENT REQUEST message created. In that case, for each and every PDN connection to be transferred:

1) if the PDN connection is for emergency bearer services, the request type shall be set to "existing emergency PDU session". Otherwise the request type shall be set to "existing PDU session";

2) if the previously allocated home address information for a PDN connection consists of an IPv4 address only for an ePDG connected to EPC according to 3GPP TS 24.302 [16], the PDU session type shall be set to "IPv4";

3) if the previously allocated home address information for a PDN connection consists of an IPv6 prefix only for an ePDG connected to EPC according to 3GPP TS 24.302 [16], the PDU session type shall be set to "IPv6";

4) if the previously allocated home address information for a PDN connection consists of both an IPv4 address and an IPv6 prefix for an ePDG connected to EPC according to 3GPP TS 24.302 [16], the PDU session type shall be set to "IPv4v6";

5) the APN of the PDN connection shall be mapped to the DNN of the PDU session;

6) the PDU session ID shall be set to the PDU session identity in the N1_MODE_CAPABILITY Notify payload of the IKE_AUTH request message establishing IPsec tunnel of the PDN connection;

7) if the PDN connection is not for emergency bearer services, the S-NSSAI of the PDU session shall be set to the S-NSSAI associated with the PDN connection as specified in 3GPP TS 24.302 [16]. The UE shall not request to perform handover of an existing PDN connection to N1 mode over 3GPP access if the associated S-NSSAI is not included in the allowed NSSAI for 3GPP access; and

8) the SSC mode IE shall be set to "SSC mode 1".

If an existing PDU session is transferred from 3GPP access to an ePDG connected to EPC connection and that existing PDU session is associated with one or more MBS sessions, the UE shall locally leave the associated multicast MBS sessions and the SMF shall consider the UE as removed from the associated multicast MBS sessions.

Upon inter-system change to N1 mode, for the PDN connection(s) via an ePDG connected to EPC transferred to the 5GS, if the UE supports reporting of URSP rule enforcement and is indicated to send URSP rule enforcement report to the network based on the matching URSP rule newly enforced while the PDN connection is via an ePDG connected to EPC, which contains the URSP rule enforcement report indication set to "URSP rule enforcement report is required", the UE shall include the URSP rule enforcement reports IE in the PDU SESSION ESTABLISHMENT REQUEST message.

6.2 General on elementary 5GSM procedures

6.2.1 Principles of PTI handling for 5GSM procedures

When the UE or the network initiates a transaction related procedure (i.e. a procedure consisting of more than one message and the messages are related), it shall include a valid PTI value in the message header of the request message or of the command message.

If a response message is sent as result of a received request message or a received command message, the sending entity shall include in the response message the PTI value received within the request message or within the command message (see examples in figure 6.2.1.1, figure 6.2.1.2, and figure 6.2.1.3).

If a command message is sent as result of a received request message, the sending entity shall include in the command message the PTI value received with the request message (see examples in figure 6.2.1.3).

If a command message is not sent as result of a received request message, the sending entity shall include in the command message the PTI value set to "no procedure transaction identity assigned" (see examples in figure 6.2.1.4).

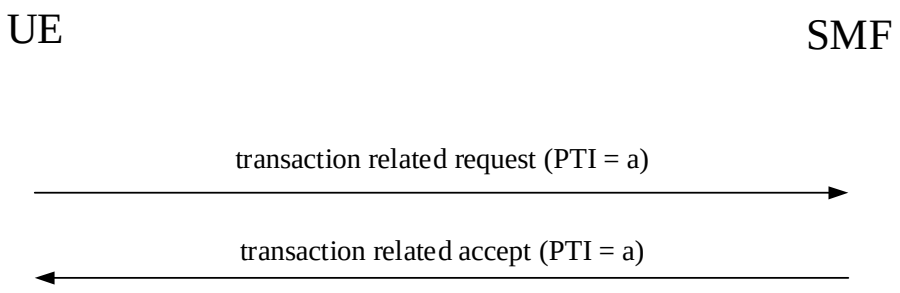


Figure 6.2.1.1: UE-requested transaction related procedure accepted by the network

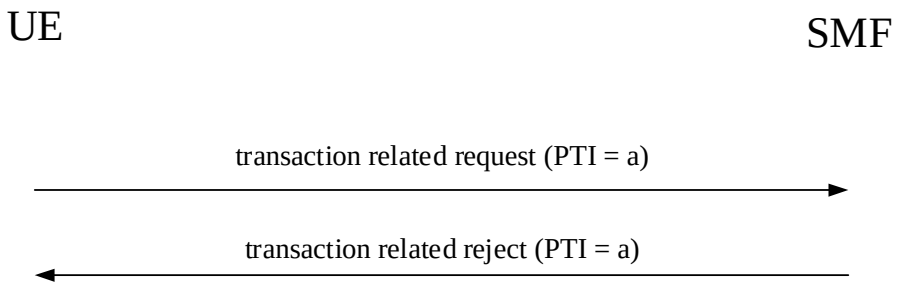


Figure 6.2.1.2: UE-requested transaction related procedure rejected by the network

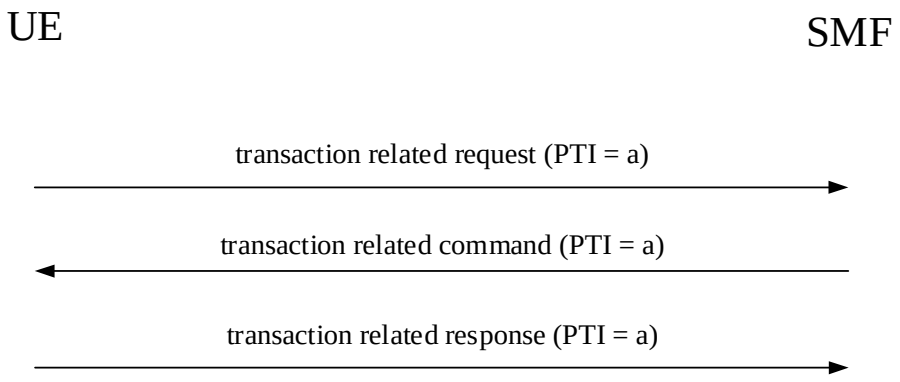


Figure 6.2.1.3: UE-requested transaction related procedure triggering a network-requested transaction related procedure

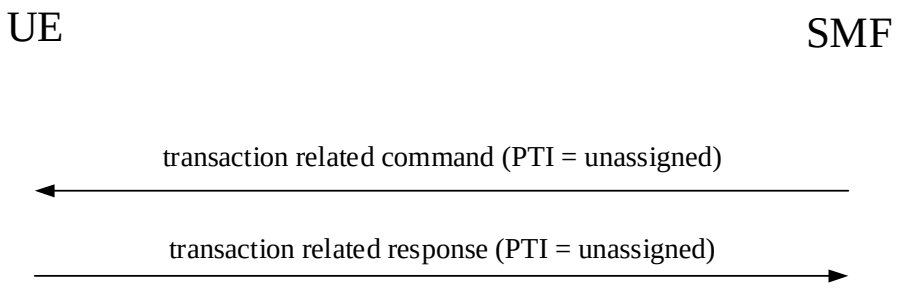


Figure 6.2.1.4: network-requested transaction related procedure not triggered by a UE-requested transaction related procedure

6.2.2 PDU session types

The following PDU Session types are supported:

a) IPv4;

b) IPv6;

c) IPv4v6;

d) Ethernet (EtherType as defined in IEEE Std 802.3 [31A]); and

e) Unstructured.

IP address allocation for IPv4, IPv6 and IPv4v6 PDU session types is described in subclause 6.2.4.

Neither a MAC nor an IP address is allocated by the 5GCN to the UE for Ethernet PDU session type.

6.2.3 PDU session management

The SMF is responsible for the session management functions to provide the PDU connectivity service to the UE via the 5GSM signalling between UE and SMF. The session management procedures includes:

a) the UE-requested PDU session establishment procedure;

b) the PDU session authentication and authorization procedure;

c) the UE-requested PDU session modification procedure;

d) the network-requested PDU session modification procedure;

e) the UE-requested PDU session release procedure; and

f) the network-requested PDU session release procedure.

A UE may establish multiple PDU sessions, to the same data network or to different data networks, via 3GPP access and via non-3GPP access at the same time. It is not required for a UE to initiate the PDU session release procedure to release a PDU session associated with another access, if any, due to the reason that the UE initiates the registration procedure or PDU session establishment procedure over the current access.

NOTE: PDU session is managed independently between 3GPP access and non-3GPP access.

The session management messages between UE and SMF are transferred via AMF as specified in subclause 8.3.

6.2.4 IP address allocation

6.2.4.1 General

This clause specifies IP address allocation for the PDU session.

In this release of specification, PDU session can be initiated with one IP version, i.e. IPv4 PDU session type or IPv6 PDU session type, or with both IP versions, i.e. IPv4v6 PDU session type.

IP address allocation to the UE shall be performed by SMF based on one or both the selected IP versions and operator policies. If IPv4 PDU session type is selected, an IPv4 address is allocated to the UE. If IPv6 PDU session type is selected, an IPv6 prefix except when the SMF acts according to subclause 6.2.4.3, and an interface identifier for the IPv6 link local address are allocated to the UE. If IPv4v6 PDU session type is selected, an IPv4 address, an IPv6 prefix except when the SMF acts according to subclause 6.2.4.3 or 6.2.4.4, and an interface identifier for the IPv6 link local address are allocated to the UE. If IPv6 or IPv4v6 PDU session type is selected in a PDU session established by the W-AGF acting on behalf of the FN-RG and the PDU SESSION ESTABLISHMENT REQUEST message contains the Suggested interface identifier IE, the SMF shall allocate to the UE the interface identifier for the IPv6 link local address indicated in the Suggested interface identifier IE.

For IPv4 PDU session type and for IPv4v6 PDU session type, the UE:

a) shall obtain an IPv4 address via:

   1) NAS signalling as specified in subclause 6.2.4.2; or

   2) DHCPv4 as specified in IETF RFC 2131 [33E]; and

b) may obtain IPv4 configuration parameters (e.g. DNS server address) via DHCPv4 as specified in IETF RFC 2132 [33F] or may receive IPv4 configuration parameters (e.g. DNS server address) as specified in subclause 6.4.1 and subclause 6.3.2.

For IPv6 PDU session type and for IPv4v6 PDU session type, the UE:

a) shall build an IPv6 link local address based on the allocated interface identifier for the IPv6 link local address;

b) shall obtain /64 IPv6 prefix via IPv6 stateless address autoconfiguration as specified in 3GPP TS 23.501 [8] and IETF RFC 4862 [39], except when the 5G-RG or the W-AGF act according to subclause 6.2.4.3;

c) may obtain IPv6 configuration parameters via stateless DHCPv6 as specified in IETF RFC 8415 [33D], except when the 5G-RG or the W-AGF act according to subclause 6.2.4.3, may receive IPv6 configuration parameters (e.g. DNS server address) as specified in subclause 6.4.1 and subclause 6.3.2, or may receive DNS server IPv6 addresses in a Router Advertisement Message as specified in IETF RFC 4861 [38B] with recursive DNS server option as specified in IETF RFC 8106 [52];and

d) may obtain an additional IPv6 prefix for a PDU session by IPv6 prefix delegation via DHCPv6 as specified in subclause 6.2.4.2a.

6.2.4.2 IP address allocation via NAS signalling

The UE shall set the PDU session type IE in the PDU SESSION ESTABLISHMENT REQUEST message, based on its IP stack capabilities if the UE requests IP connectivity as follows:

a) A UE:

   1) which is IPv6 and IPv4 capable, shall set the PDU session type IE to IPv4, IPv6 or IPv4v6 according to UE configuration or received policy.

   2) which is only IPv6 capable, shall set the PDU session type IE to IPv6.

   3) which is only IPv4 capable, shall set the PDU session type IE to IPv4.

b) When the IP version capability of the UE is unknown in the UE (as in the case when the MT and TE are separated and the capability of the TE is not known in the MT), the UE shall set the PDU session type IE to IPv4v6.

If the UE wants to use DHCPv4 for IPv4 address assignment, it shall indicate that to the network within the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT REQUEST.

On receipt of the PDU SESSION ESTABLISHMENT REQUEST message sent by the UE, the network when allocating an IP address shall take into account the PDU session type IE, the operator's policies of the network, and the user's subscription data and:

a) if the network sets the Selected PDU session type IE to IPv4, the network shall include an IPv4 address in the PDU address IE;

b) if the network sets the Selected PDU session type IE to IPv6, the network shall include an interface identifier for the IPv6 link local address in the PDU address IE; and

c) if the network sets the Selected PDU session type IE to IPv4v6, the network shall include an IPv4 address and an interface identifier for the IPv6 link local address in the PDU address IE.

6.2.4.2a IPv6 prefix delegation via DHCPv6

In order to perform the IPv6 prefix delegation via DHCPv6, the UE shall use DHCPv6 to request additional IPv6 prefixes (i.e. prefixes shorter than the default /64 prefix) from the SMF. The UE shall act as a "Requesting Router" as described in IETF RFC 8415 [33D] and shall insert one or more identity association for prefix delegation options into a DHCPv6 Solicit message.

If the IPv6 address allocation using IPv6 stateless address autoconfiguration is used, the UE sends the DHCPv6 message to request additional IPv6 prefixes to the SMF after the PDU session establishment and IPv6 prefix allocation.

When the UE requests additional prefixes using DHCPv6, the UE may include DHCPv6 Rapid Commit option as specified in IETF RFC 8415 [33D] in a DHCPv6 Solicit message, and the UE other than the ones specified in subclause 6.2.4.3 shall include DHCPv6 OPTION_ORO option with the OPTION_PD_EXCLUDE option code as specified in IETF RFC 6603 [40A] in the DHCPv6 message.

Upon receiving one or more identity association for prefix delegation prefixes in a DHCPv6 Reply message, the UE is allowed to use the allocated additional prefixes after inter-system change from N1 mode to S1 mode or from S1 mode to N1 mode.

6.2.4.3 Additional RG related requirements for IP address allocation

If IPv6 PDU session type or IPv4v6 PDU session type is selected, an IPv6 address, one or more IPv6 prefixes or both are allocated to the 5G-RG or the W-AGF acting on behalf of the FN-RG (or on behalf of the N5GC device).

If the 5G-RG or the W-AGF acting on behalf of the FN-RG (or on behalf of the N5GC device) receives a Router Advertisement Message as specified in IETF RFC 4861 [38B] with the "Managed address configuration" flag set to zero, the 5G-RG and the W-AGF acting on behalf of the FN-RG (or on behalf of the N5GC device):

a) shall obtain /64 IPv6 prefix via IPv6 stateless address autoconfiguration as specified in 3GPP TS 23.501 [8] and IETF RFC 4862 [39];

b) may obtain IPv6 configuration parameters via stateless DHCPv6 as specified in IETF RFC 8415 [33D]; and

c) may request additional IPv6 prefixes using DHCPv6. If the 5G-RG and the W-AGF acting on behalf of the FN-RG (or on behalf of the N5GC device) request IPv6 prefixes using DHCPv6, the 5G-RG and the W-AGF acting on behalf of the FN-RG (or on behalf of the N5GC device) shall act as a "Requesting Router" as described in IETF RFC 8415 [33D], shall perform procedures described in subclause 6.2.4.2a. Additionally, the 5G-RG or the W-AGF acting on behalf of the FN-RG (or on behalf of the N5GC device) may include DHCPv6 OPTION_ORO option with the OPTION_PD_EXCLUDE option code as specified in IETF RFC 6603 [40A] in the DHCP.

If the 5G-RG or the W-AGF acting on behalf of the FN-RG (or on behalf of the N5GC device) receives a Router Advertisement Message as specified in IETF RFC 4861 [38B] with the "Managed address configuration" flag set to one, the 5G-RG and the W-AGF acting on behalf of the FN-RG (or on behalf of the N5GC device):

a) shall obtain an IPv6 address via DHCPv6 and the DHCPv6 Identity association for non-temporary addresses option as specified in IETF RFC 8415 [33D];

b) may obtain IPv6 configuration parameters via DHCPv6 as specified in IETF RFC 8415 [33D]; and

c) may request IPv6 prefixes using DHCPv6. If the 5G-RG and the W-AGF acting on behalf of the FN-RG (or on behalf of the N5GC device) requests IPv6 prefixes using DHCPv6, the 5G-RG and the W-AGF acting on behalf of the FN-RG (or on behalf of the N5GC device) shall act as a "Requesting Router" as described in IETF RFC 8415 [33D], shall perform procedures described in subclause 6.2.4.2a. Additionally, the 5G-RG or the W-AGF acting on behalf of the FN-RG (or on behalf of the N5GC device) may include DHCPv6 OPTION_ORO option with the OPTION_PD_EXCLUDE option code as specified in IETF RFC 6603 [40A] in the DHCP message. The 5G-RG or the W-AGF acting on behalf of the FN-RG (or on behalf of the N5GC device) may include both IA_PD option and IA_NA option to request the delegated prefix together with the IPv6 address in the same DHCPv6 message.

NOTE: The 5G-RG and the W-AGF acting on behalf of the FN-RG (or on behalf of the N5GC device) can send multiple DHCPv6 requests with different DHCPv6 Identity association for non-temporary addresses options when the 5G-RG or the FN-RG acts as a DHCP relay for devices behind the 5G-RG or the FN-RG.

The 5G-RG may obtain ACS information via DHCP as specified in subclause 3.1 of BBF TR-069 [49] or in BBF TR-369 [50] R-DIS.1 and R-DIS.2.

6.2.4.4 Additional requirements of the UE acting as 5G ProSe layer-3 UE-to-network relay UE for IP address allocation

If a UE acting as 5G ProSe layer-3 UE-to-network relay needs to indicate "IPv6 Router" or "DHCPv4 Server & IPv6 Router" in the IP address configuration IE as specified in 3GPP 24.554 [19E], the UE shall support acting as a "Requesting Router" as described in IETF RFC 8415 [33D] to request additional IPv6 prefixes (i.e. prefixes in addition to the /64 default prefix which was allocated via stateless IPv6 address autoconfiguration as specified in subclause 6.2.4.1) from the SMF as specified in subclause 5.5.2 of 3GPP TS 23.304 [6E].

When the UE acting as 5G ProSe layer-3 UE-to-network relay UE requests additional prefixes using DHCPv6, the UE shall perform procedures described in subclause 6.2.4.2a.

6.2.5 Quality of service

6.2.5.1 General

6.2.5.1.1 QoS rules

6.2.5.1.1.1 General

In a PDU session of IPv4, IPv6, IPv4v6 and Ethernet PDU session type, the NAS protocol enables different forwarding treatments of UL user data packets in one or more QoS flows based on signalled QoS rules, derived QoS rules or any combination of them.

In a PDU session of Unstructured PDU session type, all UL user data packets are associated with the same QoS flow.

6.2.5.1.1.2 Signalled QoS rules

The NAS protocol enables the network to provide the UE with signalled QoS rules associated with a PDU session.

The network can provide the UE with one or more signalled QoS rules associated with a PDU session at the PDU session establishment or at the PDU session modification.

Each signalled QoS rule contains:

a) an indication of whether the QoS rule is the default QoS rule;

b) a QoS rule identifier (QRI);

c) a QoS flow identifier (QFI);

d) optionally, a set of packet filters; and

e) a precedence value.

NOTE 1: The default QoS rule indication (DQR) of a signalled QoS rule cannot be changed.

For case d) above:

1) If the QoS rule is the default QoS rule of a PDU session of IPv4, IPv6, IPv4v6 or Ethernet PDU session type, the set of packet filters contains zero or more packet filters for DL direction, and may additionaly contain one of the following:

   A) a match-all packet filter for UL direction;

   B) a match-all packet filter for UL and DL directions;

   C) zero or more packet filters for UL direction (other than the match-all packet filter for UL direction);

   D) zero or more packet filters for UL and DL directions (other than the match-all packet filter for UL and DL directions); or

   E) one or more packet filters for UL direction (other than the match-all packet filter for UL direction) and one or more packet filters for UL and DL directions (other than the match-all packet filter for UL and DL directions).

   The set of packet filters for the default QoS rule shall not be empty. If the default QoS rule contains a match-all packet filter, then the highest precedence value shall be used for the default QoS rule.

NOTE 1a: Set of packet filters for the default QoS rule can contain only packet filters for DL direction e.g. for determination that local preconditions are met in an IMS session (see 3GPP TS 24.229 [14]) with a receive only media.

2) If the QoS rule is a QoS rule of a PDU session of IPv4, IPv6, IPv4v6 or Ethernet PDU session type and is not the default QoS rule, the set of packet filters contains zero or more packet filters for the DL direction, and may additionally contain one of the following:

   A) zero or more packet filters for UL direction (other than the match-all packet filter for UL direction); and

   B) zero or more packet filters for both UL and DL directions (other than the match-all packet filter for UL and DL directions).

   The set of packet filters for a QoS rule which is not the default QoS rule shall not be empty.

NOTE 1b: Set of packet filters for a QoS rule which is not the default QoS rule can contain only packet filters for DL direction e.g. for determination that local preconditions are met in an IMS session (see 3GPP TS 24.229 [14]) with a receive only media.

3) For PDU session of unstructured PDU session type, there is only one QoS rule associated with it and the set of packet filters of that QoS rule is empty.

If the UE requests a new QoS rule, it shall assign a precedence value for the signalled QoS rule which is not in the range from 70 to 99 (decimal).

NOTE 2: In this release of the specification, there is no support for a match-all packet filter for DL direction.

NOTE 3: In order to support QoS differentiation in case of access to PLMN services via an SNPN, the UE, within the SNPN, can construct packet filters based on the destination IP address to reach the N3IWF in the PLMN and the security parameters index (SPI) for the IPsec SA.

NOTE 4: In order to support QoS differentiation in case of access to SNPN services via a PLMN, the UE, within the PLMN, can construct packet filters based on the destination IP address to reach the N3IWF in the SNPN and the security parameters index (SPI) for the IPsec SA.

NOTE 5: The above described condition of assigning a precedence value for the signalled QoS rule is applied to the UE when the UE requests a QoS rule for network to bind service data flows described by the QoS rule to a dedicated QoS flow by setting the segregation bit to 1.

In NB-N1 mode, there is only one QoS rule associated with a PDU session and that is the default QoS rule. As described in 3GPP TS 23.501 [8], when the SMF determines that the UE has:

a) moved from a tracking area in WB-N1 mode into a tracking area in NB-N1 mode;

b) moved from a tracking area in WB-S1 mode into a tracking area in NB-N1 mode; or

c) moved from a tracking area in NR connected to 5GCN into a tracking area in NB-N1 mode;

the SMF shall, for each PDU session that is kept active, initiate the PDU session modification procedure (see subclause 6.3.3.2) to delete every QoS rule that is not the default QoS rule, if any.

Within a PDU session:

a) each signalled QoS rule has a unique QRI;

b) there is at least one signalled QoS rule;

c) one signalled QoS rule is the default QoS rule; and

d) there can be zero, one or more signalled QoS rules associated with a given QFI.

6.2.5.1.1.3 Derived QoS rules

Derived QoS rules are applicable only for PDU session of IPv4, IPv6, IPv4v6 or Ethernet PDU session type.

The reflective QoS in the UE creates derived QoS rules associated with a PDU session based on DL user data packets received via the PDU session.

Each derived QoS rule contains:

a) a QoS flow identifier (QFI);

b) a packet filter for UL direction; and

c) a precedence value of 80 (decimal).

NOTE: On the network side, the corresponding QoS rule can be associated with a different precedence value in the range from 70 to 99 (decimal).

Within a PDU session:

a) there can be zero, one or more derived QoS rules associated with a given QFI; and

b) there can be up to one derived QoS rule associated with a given packet filter for UL direction.

In the UE, a timer T3583 runs for each derived QoS rule.

Reflective QoS is not supported in NB-N1 mode. Reflective QoS is not applicable for a PDU session with control plane only indication.

6.2.5.1.1.4 QoS flow descriptions

The network can also provide the UE with one or more QoS flow descriptions associated with a PDU session at the PDU session establishment or at the PDU session modification.

Each QoS flow description contains:

a) a QoS flow identifier (QFI);

b) if the flow is a GBR QoS flow:

1) Guaranteed flow bit rate (GFBR) for UL;

2) Guaranteed flow bit rate (GFBR) for DL;

3) Maximum flow bit rate (MFBR) for UL;

4) Maximum flow bit rate (MFBR) for DL; and

5) optionally averaging window, applicable for both UL and DL;

c) 5QI, if the QFI is not the same as the 5QI of the QoS flow identified by the QFI; and

d) optionally, an EPS bearer identity (EBI) if the QoS flow can be mapped to an EPS bearer as specified in subclause 4.11.1 of 3GPP TS 23.502 [9].

If the averaging window is not included in a QoS flow description for a GBR QoS flow with a 5QI indicated in 3GPP TS 23.501 [8] table 5.7.4-1, the averaging window associated with the 5QI in 3GPP TS 23.501 [8] table 5.7.4-1 applies for the averaging window.

If the averaging window is not included in a QoS flow description for a GBR QoS flow with a 5QI not indicated in 3GPP TS 23.501 [8] table 5.7.4-1, the standardized value of two seconds is used as the averaging window.

6.2.5.1.2 Session-AMBR

The NAS protocol enables the network to provide the UE with the session-AMBR associated with a PDU session.

The standardized value of two seconds is used as the averaging window for the UE's enforcement of the UL rate limitation indicated by the session-AMBR.

6.2.5.1.2A Void

6.2.5.1.3 UL user data packet matching

For PDU session of IPv4, IPv6, IPv4v6 or Ethernet PDU session type, upon receiving an UL user data packet from the upper layers for transmission via a PDU session, the UE shall attempt to associate the UL user data packet with:

a) the QFI of a signalled QoS rule associated with the PDU session which has a set of packet filters containing a packet filter for UL direction matching the UL user data packet or containing a packet filter for both UL and DL directions matching the UL user data packet; or

b) the QFI of a derived QoS rule associated with the PDU session which has the packet filter for UL direction matching the UL user data packet;

by evaluating the QoS rules in increasing order of their precedence values until the UL user data packet is associated with a QFI or all QoS rules are evaluated.

For PDU session of unstructured PDU session type, upon receiving an UL user data packet from the upper layers for transmission via a PDU session, the UE shall associate the UL user data packet with the QFI of the default QoS rule associated with the PDU session.

If the UL user data packet is associated with a QFI, the UE shall pass the QFI along the UL user data packet to the lower layers for transmission.

NOTE: Marking of the UL user data packet with the QFI is performed by the lower layers.

If all QoS rules are evaluated and the UL user data packet is not associated with a QFI, the UE shall discard the UL user data packet.

6.2.5.1.4 Reflective QoS

6.2.5.1.4.1 General

The UE may support reflective QoS.

If the UE supports the reflective QoS, the UE shall support the procedures in the following subclauses.

The reflective QoS is applicable in a PDU session of IPv4, IPv6, IPv4v6 and Ethernet PDU session type. The reflective QoS is not applicable in a PDU session of Unstructured PDU session type. Reflective QoS is not applicable for a PDU session with control plane only indication.

The UE may request to revoke the usage of reflective QoS for an existing PDU session for which the UE had previously indicated support for reflective QoS.

6.2.5.1.4.2 Derivation of packet filter for UL direction from DL user data packet

If the UE needs to derive a packet filter for UL direction from the DL user data packet (see subclause 6.2.5.1.4.3 and 6.2.5.1.4.4), the UE shall proceed as follows:

a) if the received DL user data packet belongs to a PDU session of IPv4 or IPv4v6 PDU session type and is an IPv4 packet and:

   1) the protocol field of the received DL user data packet indicates TCP as specified in IETF RFC 793 [33];

   2) the protocol field of the received DL user data packet indicates UDP as specified in IETF RFC 768 [32]; or

   3) the protocol field of the received DL user data packet indicates ESP as specified in IETF RFC 4303 [38] and an uplink IPSec SA corresponding to a downlink IPSec SA indicated in the security parameters index field of the received DL user data packet exists;

   then the packet filter for UL direction contains the following packet filter components:

   1) an IPv4 remote address component set to the value of the source address field of the received DL user data packet;

   2) an IPv4 local address component set to the value of the destination address field of the received DL user data packet;

   3) a protocol identifier/next header type component set to the value of the protocol field of the received DL user data packet;

   4) if the protocol field of the received DL user data packet indicates TCP as specified in IETF RFC 793 [33] or UDP as specified in IETF RFC 768 [32]:

      i) a single local port type component set to the value of the destination port field of the received DL user data packet; and

      ii) a single remote port type component set to the value of the source port field of the received DL user data packet;

   5) if the protocol field of the received DL user data packet indicates ESP as specified in IETF RFC 4303 [38], an uplink IPSec SA corresponding to a downlink IPSec SA of the SPI in the DL user data packet exists and the SPI of the uplink IPSec SA is known to the NAS layer:

      i) a security parameter index type component set to the security parameters index of the uplink IPSec SA corresponding to the downlink IPSec SA indicated in the security parameters index field of the received DL user data packet; and

   6) if the protocol field of the received DL user data packet indicates UDP and the received DL user data packet contains a UDP-encapsulated ESP header as specified in IETF RFC 3948 [55], an uplink IPSec SA corresponding to a downlink IPSec SA of the SPI in the DL user data packet exists and the SPI of the uplink IPSec SA is known to the NAS layer:

      i) a security parameter index type component set to the security parameters index of the uplink IPSec SA corresponding to the downlink IPSec SA indicated in the security parameters index field of the ESP header field of the UDP-encapsulated ESP header as specified in IETF RFC 3948 [55] of the received DL user data packet;

   otherwise it is not possible to derive a packet filter for UL direction from the DL user data packet;

b) if the received DL user data packet belongs to a PDU session of IPv6 or IPv4v6 PDU session type and is an IPv6 packet and:

   1) the last next header field of the received DL user data packet indicates TCP as specified in IETF RFC 793 [33];

2) the last next header field of the received DL user data packet indicates UDP as specified in IETF RFC 768 [32]; or

3) the last next header field of the received DL user data packet indicates ESP as specified in IETF RFC 4303 [38] and an uplink IPSec SA corresponding to a downlink IPSec SA indicated in the security parameters index field of the received DL user data packet exists;

then the packet filter for UL direction contains the following packet filter components:

1) an IPv6 remote address/prefix length component set to the value of the source address field of the received DL user data packet;

2) an IPv6 local address/prefix length component set to the value of the destination address field of the received DL user data packet;

3) a protocol identifier/next header type component set to the value of the last next header field of the received DL user data packet;

4) if the last next header field of the received DL user data packet indicates TCP as specified in IETF RFC 793 [33] or UDP as specified in IETF RFC 768 [32]:

   i) a single local port type component set to the value of the destination port field of the received DL user data packet; and

   ii) a single remote port type component set to the value of the source port field of the received DL user data packet;

5) if the last next header field of the received DL user data packet indicates ESP as specified in IETF RFC 4303 [38], an uplink IPSec SA corresponding to a downlink IPSec SA of the SPI in the DL user data packet exists and the SPI of the uplink IPSec SA is known to the NAS layer:

   i) a security parameter index type component set to the security parameters index of the uplink IPSec SA corresponding to the downlink IPSec SA indicated in the security parameters index field of the received DL user data packet; and

6) if the last next header field of the received DL user data packet indicates UDP, and the received DL user data packet contains a UDP-encapsulated ESP header as specified in IETF RFC 3948 [55], an uplink IPSec SA corresponding to a downlink IPSec SA of the SPI in the DL user data packet exists and the SPI of the uplink IPSec SA is known to the NAS layer:

   i) a security parameter index type component set to the security parameters index of the uplink IPSec SA corresponding to the downlink IPSec SA indicated in the security parameters index field of the ESP header field of the UDP-encapsulated ESP header as specified in IETF RFC 3948 [55] of the received DL user data packet;

otherwise it is not possible to derive a packet filter for UL direction from the DL user data packet;

c) if the received DL user data packet belongs to a PDU session of Ethernet PDU session type, the packet filter for UL direction contains the following packet filter components:

1) a destination MAC address component set to the source MAC address of the received DL user data packet;

2) a source MAC address component set to the destination MAC address of the received DL user data packet;

3) if one or more 802.1Q C-TAG is included in the received DL user data packet, an 802.1Q C-TAG VID component set to the outermost 802.1Q C-TAG VID of the received DL user data packet and an 802.1Q C-TAG PCP/DEI component set to the outermost 802.1Q C-TAG PCP/DEI of the received DL user data packet;

4) if one or more 802.1Q S-TAG is included in the received DL user data packet, an 802.1Q S-TAG VID component set to the outermost 802.1Q S-TAG VID of the received DL user data packet and an 802.1Q S-TAG PCP/DEI component set to the outermost 802.1Q S-TAG PCP/DEI of the received DL user data packet;

5) If the Ethertype field of the received DL user data packet is set to a value of 1536 or above, an Ethertype component set to the Ethertype of the received DL user data packet;

6) if the Ethertype field of the Ethernet frame header indicates that the data carried in the Ethernet frame is IPv4 data, the UE shall also add to the packet filter for UL direction the IP-specific components based on the contents of the IP header of the received DL user data packet as described in bullet a) above; and

7) if the Ethertype field of the Ethernet frame header indicates that the data carried in the Ethernet frame is IPv6 data, the UE shall also add to the packet filter for UL direction the IP-specific components based on the contents of the IP header of the received DL user data packet as described in bullet b) above; and

d) if the received DL user data packet belongs to a PDU session of PDU session type other than Ethernet, IPv4, IPv6 and IPv4v6, it is not possible to derive a packet filter for UL direction from the DL user data packet.

6.2.5.1.4.3 Creating a derived QoS rule by reflective QoS in the UE

If the UE receives a DL user data packet marked with a QFI and an RQI, the DL user data packet belongs to a PDU session of IPv4, IPv6, IPv4v6 or Ethernet PDU session type, and the UE does not have a derived QoS rule with the same packet filter for UL direction as the packet filter for UL direction derived from the DL user data packet as specified in subclause 6.2.5.1.4.2, then the UE shall create a new derived QoS rule as follows:

a) the QFI of the derived QoS rule is set to the received QFI;

b) the precedence value of the derived QoS rule is set to 80 (decimal); and

c) the packet filter for UL direction of the derived QoS rule is set to the derived packet filter for UL direction;

and the UE shall start the timer T3583 associated with the derived QoS rule with the RQ timer value last received during the UE-requested PDU session establishment procedure of the PDU session (see subclause 6.4.1) or the network-requested PDU session modification procedure of the PDU session (see subclause 6.4.2). If the RQ timer value was received neither in the UE-requested PDU session establishment procedure of the PDU session nor in any network-requested PDU session modification procedure of the PDU session, the default standardized RQ timer value is used.

6.2.5.1.4.4 Updating a derived QoS rule by reflective QoS in the UE

If the UE receives a DL user data packet associated with a QFI and an RQI, the DL user data packet belongs to a PDU session of IPv4, IPv6, IPv4v6 or Ethernet PDU session type, and the UE has a derived QoS rule with the same packet filter for UL direction as the packet filter for UL direction derived from the DL user data packet as specified in subclause 6.2.5.1.4.2:

a) the UE shall re-start the timer T3583 associated with the derived QoS rule with the RQ timer value last received during the UE-requested PDU session establishment procedure of the PDU session (see subclause 6.4.1) or the network-requested PDU session modification procedure of the PDU session (see subclause 6.4.2). If the RQ timer value was received neither in the UE-requested PDU session establishment procedure of the PDU session nor in any network-requested PDU session modification procedure of the PDU session, the default standardized RQ timer value is used; and

b) if the QFI value associated with the DL user data packet is different from the QFI value stored for the derived QoS rule, the UE shall replace the QFI value stored for the derived QoS rule with the new QFI value for the derived QoS rule.

6.2.5.1.4.5 Deleting a derived QoS rule in the UE

Upon expiry of timer T3583 associated with a derived QoS rule, the UE shall remove the derived QoS rule.

Upon release of the PDU session, the UE shall remove the derived QoS rule(s) associated with the PDU session.

If the network accepts the request from the UE to revoke the usage of reflective QoS and sets the value of the RQ timer to "deactivated" or zero, the UE shall remove the derived QoS rule(s) associated with the PDU session.

Upon inter-system mobility from WB-N1 mode to NB-N1 mode or from NR connected to 5GCN to NB-N1 mode, the UE shall remove the derived QoS rule(s) associated with the PDU session that is kept active.

When a derived QoS rule is deleted, the timer T3583 associated with the derived QoS rule shall be stopped.

6.2.5.1.4.6 Ignoring RQI in the UE

If the UE receives a DL user data packet marked with a QFI and an RQI and it is not possible to derive a packet filter for UL direction from the DL user data packet as specified in subclause 6.2.5.1.4.2, the UE shall ignore the RQI and shall handle the received DL user data packet.

6.2.5.2 QoS in MA PDU session

In an MA PDU session, unless it :

a) is established over non-3GPP access; and

b) has a PDN connection as a user-plane resource;

the UE shall have one set of QoS rules, one set of QoS flow descriptions and one session-AMBR. The network can provide the set of QoS rules, the set of QoS flow descriptions and the session-AMBR of the MA PDU session via either access of the MA PDU session. In an MA PDU session, the UE shall support:-

- modification or deletion via an access of a QoS rule or a QoS flow description; and
- modification via an access of the session-AMBR;

of the MA PDU session created via the same or the other access.

In an MA PDU session:

a) established over non-3GPP access; and

b) with a PDN connection as a user-plane resource;

the UE shall have two sets of QoS rules, two sets of QoS flow descriptions and two session-AMBR values - one is maintained via non-3GPP access and the other is associated with EPS bearer contexts of the PDN connection and maintained via Extended protocol configuration options IE parameters received via the PDN connection.

6.2.6 Local area data network (LADN)

The UE can receive the local area data network (LADN) information consisting of LADN DNNs and LADN service area information (a set of tracking areas that belong to the current registration area) during the registration procedure or the generic UE configuration update procedure (see subclause 5.5.1 and subclause 5.4.4).

If the UE supports LADN per DNN and S-NSSAI, the UE can additionally receive the extended local area data network (LADN) information consisting of LADN DNNs, S-NSSAIs and LADN service area information (a set of tracking areas configured per DNN and S-NSSAI that belong to the current registration area) during the registration procedure or the generic UE configuration update procedure (see subclause 5.5.1 and subclause 5.4.4).

If the UE is not operating in SNPN access operation mode, the UE considers the received LADN information or the extended LADN information to be valid only in the TAIs of the registered PLMN that are in the LADN service area information, and in the TAIs of the equivalent PLMNs if the LADN service area information includes TAIs for the equivalent PLMNs. When the AMF provides the UE with LADN service area information containing TAIs for the equivalent PLMNs, the AMF shall include these TAIs of the equivalent PLMNs in the UE's registration area.

If the UE is operating in SNPN access operation mode, the UE considers the received LADN information or the extended LADN information to be valid only in the TAIs of the registered SNPN that are in the LADN service area information.

The LADN DNN(s) received by the UE is also considered as LADN DNN(s) in the equivalent PLMNs.

The UE shall consider itself to be located inside the LADN service area based on the LADN service area information. If the UE does not have an LADN service area information for the LADN DNN, the UE shall consider itself to be located outside the LADN service area.

When the UE is located in the LADN service area and the UE is in substate 5GMM-REGISTERED.NORMAL-SERVICE, the UE may initiate:

- the UE-requested PDU session establishment procedure with an LADN DNN to establish a PDU session for LADN;
- the UE-requested PDU session establishment procedure with an LADN DNN and an S-NSSAI associated with the LADN to establish a PDU session for LADN if the extended LADN information is available at the UE;
- the UE-requested PDU session modification procedure to modify the PDU session for LADN;
- the service request procedure to re-establish the user-plane resources for the PDU session for LADN; or
- the service request procedure or the UE-initiated NAS transport procedure to send CIoT user data via the control plane for a PDU session for LADN.

NOTE 1: If the service area list for the service area restriction is available in the UE, and at least one of the LADN information or the extended LADN information are available in the UE, the service area list is evaluated before the LADN information and extended LADN information.

NOTE 1A: If the partially allowed NSSAI, the partially rejected NSSAI, or both are available in the UE, and at least one of the LADN information or the extended LADN information are available in the UE, the UE evaluates the partially allowed NSSAI and the partially rejected NSSAI before the LADN information and extended LADN information.

When the UE is located outside the LADN service area, the UE is allowed:

- to initiate the UE-requested PDU session release procedure to release a PDU session for LADN; or
- to initiate the UE-requested PDU session modification procedure to indicate a change of 3GPP PS data off UE status.

The AMF shall determine the UE presence in LADN service area as out of the LADN service area in the following cases:

- if the DNN used for the LADN is included in the LADN information and the UE is located outside the LADN service area indicated in the LADN information;
- if the DNN and the S-NSSAI used for the LADN are included in the extended LADN information and the UE is located outside the LADN service area indicated in the extended LADN information;
- if the DNN used for the LADN is included in the extended LADN information and there is no S-NSSAI provided by the UE to establish a PDU session for LADN; or
- if the DNN used for the LADN is included in the extended LADN information and the S-NSSAI provided by the UE to establish a PDU session for LADN is not associated with that LADN.

If the UE has moved out of the LADN service area:

a) the SMF shall:

   1) release the PDU session for LADN; or

   2) release the user-plane resources for the PDU session for LADN and maintain the PDU session for LADN;

   according to operator's policy; and

b) the SMF shall not initiate the transfer of CIoT user data via the control plane to the UE for the PDU session for LADN.

In case a2) and b):

- if the UE has returned to the LADN service area within a specific period of time according to operator's policy, and the network has downlink user data pending, the network re-establishes the user-plane resources for the PDU session for LADN;
- if the UE has returned to the LADN service area within a specific period of time according to operator's policy, and the network has downlink CIoT user data pending, the SMF shall initiate the CIoT user data via the control plane transfer to the UE; and

- if the UE has not returned to the LADN service area after a specific period of time according to operator's policy, the SMF may release the PDU session for LADN.

When the UE moves to 5GMM-DEREGISTERED state, the UE shall delete the stored LADN information, if any, and the stored extended LADN information, if any.

NOTE 2: In this release, LADNs apply only to 3GPP access.

Upon inter-system change from N1 mode to S1 mode in EMM-IDLE mode, the UE shall not transfer a PDU session for LADN to EPS.

If:

a) the UE supports LADN per DNN and S-NSSAI;

b) the UE has a PDU session established using the DNN and S-NSSAI which are not associated with any LADN service area indicated in the extended LADN information;

c) an LADN service area is configured in the extended LADN information which is associated with the DNN and S-NSSAI of the PDU session; and

d) the AMF determines the UE presence in LADN service area as out of the LADN service area configured in the extended LADN information;

the AMF requests the SMF to release this PDU session as specified in 3GPP TS 23.502 [9].

If:

a) the UE supports LADN per DNN and S-NSSAI;

b) the UE has a PDU session for LADN established; and

c) the AMF determines that the LADN service area associated with the DNN and S-NSSAI of the PDU session for LADN is removed from the extended LADN information;

the AMF requests the SMF to release this PDU session as specified in 3GPP TS 23.502 [9].

6.2.7 Handling of DNN based congestion control

The network may detect and start performing DNN based congestion control when one or more DNN congestion criteria as specified in 3GPP TS 23.501 [8] are met. If the UE does not provide a DNN for a non-emergency PDU session, then the network uses the selected DNN.

In the UE, 5GS session management timers T3396 for DNN based congestion control are started and stopped on a per DNN basis except for an LADN DNN in case of PLMN. For an LADN DNN, 5GS session management timers T3396 for DNN based congestion control is applied to the registered PLMN and its equivalent PLMNs. In case of SNPN, if the UE does not support access to an SNPN using credentials from a credentials holder and equivalent SNPNs, in the UE, 5GS session management timers T3396 for DNN based congestion control are started and stopped on a per DNN and SNPN basis. If the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, in the UE 5GS session management timers T3396 for DNN based congestion control are started and stopped on a per DNN, SNPN and selected entry of the "list of subscriber data" or selected PLMN subscription basis. Upon receipt of a 5GMM message or 5GSM message from the network for which the UE needs to stop the running timers T3396 associated with an LADN DNN as specified in subclause 6.3.2.3, 6.3.3.3, 6.4.1.4.2 and 6.4.2.4.2, only the running timer T3396 which is associated with the PLMN and equivalent PLMNs where the timer was started is stopped.

In an SNPN, if the UE supports equivalent SNPNs, the UE applies the timer T3396 for all the equivalent SNPNs, otherwise the UE applies the timer T3396 for the registered SNPN.

The DNN associated with T3396 is the DNN provided by the UE during the PDU session establishment. If no DNN is provided by the UE along the PDU SESSION ESTABLISHMENT REQUEST, then T3396 is associated with no DNN. For this purpose, the UE shall memorize the DNN provided to the network during the PDU session establishment. The timer T3396 associated with no DNN will never be started due to any 5GSM procedure related to an emergency PDU session. If the timer T3396 associated with no DNN is running, it does not affect the ability of the UE to request an emergency PDU session.

In a PLMN, if T3396 is running or is deactivated, then the UE is not allowed to initiate the:

a) PDU session establishment procedure;

b) PDU session modification procedure; or

c) NAS transport procedure for sending CIoT user data;

for the respective DNN or without a DNN unless the UE is a UE configured for high priority access in selected PLMN or to report a change of 3GPP PS data off UE status.

In an SNPN, if T3396 is running or is deactivated for the registered SNPN, is associated with a DNN or with no DNN, with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, with the selected entry of the "list of subscriber data" or the selected PLMN subscription, then the UE is not allowed to initiate the

a) PDU session establishment procedure; or

b) PDU session modification procedure;

for the respective DNN or without a DNN unless the UE is a UE configured for high priority access in the RSNPN or to report a change of 3GPP PS data off UE status.

In an SNPN, if the UE supports equivalent SNPNs, the timer T3396 is running or is deactivated for all the equivalent SNPNs, is associated with a DNN or no DNN, with the RSNPN or an equivalent SNPN, and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, then the UE is not allowed to initiate the:

a) PDU session establishment procedure; or

b) PDU session modification procedure;

for the respective DNN or without a DNN unless the UE is a UE configured for high priority access in selected SNPN or to report a change of 3GPP PS data off UE status.

If the network does not include timer T3396 with 5GSM cause #26 "insufficient resources", the UE may use a local back-off timer that has exponential value or a default value, which is provisioned using implementation specific means, to:a) prevent sending any 5GSM procedure for the respective DNN till its expiry; and

b) allow sending any 5GSM procedure for the respective DNN after its expiry.

6.2.8 Handling of S-NSSAI based congestion control

The network may detect and start performing S-NSSAI based congestion control when one or more S-NSSAI congestion criteria as specified in 3GPP TS 23.501 [8] are met. If the UE does not provide a DNN for a non-emergency PDU session, then the network uses the selected DNN. If the UE does not provide an S-NSSAI for a non-emergency PDU session, then the network uses the selected S-NSSAI.

In case of PLMN or SNPN, in the UE, 5GS session management timers T3584 for the S-NSSAI based congestion control are started and stopped on a per S-NSSAI, DNN and PLMN or SNPN basis. If the 5GSM congestion re-attempt indicator IE with the ABO bit set to "The back-off timer is applied in all PLMNs or equivalent SNPNs " is included in the 5GSM message with the 5GSM cause value #67 "insufficient resources for specific slice and DNN", then the UE applies the timer T3584 for all the PLMNs or all the equivalent SNPNs. Otherwise, the UE applies the timer T3584 for the registered PLMN or the registered SNPN. If the timer T3584 applies for all the PLMNs or all the equivalent SNPNs, the timer T3584 starts when the UE is registered in a VPLMN or an unsubscribed SNPN and the S-NSSAI is provided by the UE during the PDU session establishment, the timer T3584 is associated with the [mapped S-NSSAI, DNN] combination of the PDU session.

In case of PLMN or SNPN, in the UE, 5GS session management timers T3585 for the S-NSSAI based congestion control are started and stopped on a per S-NSSAI and PLMN or SNPN basis. If the 5GSM congestion re-attempt indicator IE with the ABO bit set to "The back-off timer is applied in all PLMNs or all equivalent SNPNs " is included in the 5GSM message with the 5GSM cause value #69 "insufficient resources for specific slice", then the UE applies the timer T3585 for all the PLMNs or all the equivalent SNPNs. Otherwise, the UE applies the timer T3585 for the registered PLMN or registered SNPN. If the timer T3585 applies for all the PLMNs or all the equivalent SNPNs, the timer T3585 starts when the UE is registered in a VPLMN or an unsubscribed SNPN and the S-NSSAI is provided by the UE during the PDU session establishment, the timer T3585 is associated with the mapped S-NSSAI of the PDU

session. Additionally, if the 5GSM congestion re-attempt indicator IE with the CATBO bit set to "The back-off timer is applied in the current access type" is included in the 5GSM message with the 5GSM cause value #69 "insufficient resources for specific slice", then the UE applies the timer T3585 for the current access type. Otherwise, the UE applies the timer T3585 for both 3GPP access type and non-3GPP access type and the UE shall stop any running timer T3585 for the applied PLMN or SNPN and for the access different from the access from which the message is received.

In case of SNPN, if the UE does not support access to an SNPN using credentials from a credentials holder and equivalent SNPNs, in the UE 5GS session management timers T3584 for the S-NSSAI based congestion control are started and stopped on a per S-NSSAI, DNN and SNPN basis. If the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, in the UE 5GS session management timers T3584 for the S-NSSAI based congestion control are started and stopped on a per S-NSSAI, DNN, SNPN and selected entry of the "list of subscriber data" or selected PLMN subscription basis.

In case of SNPN, if the UE does not support access to an SNPN using credentials from a credentials holder and equivalent SNPNs, in the UE 5GS session management timers T3585 for the S-NSSAI based congestion control are started and stopped on a per S-NSSAI and SNPN basis. If the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, in the UE 5GS session management timers T3585 for the S-NSSAI based congestion control are started and stopped on a per S-NSSAI, SNPN and selected entry of the "list of subscriber data" or selected PLMN subscription basis.

If the timer T3584 or timer T3585 was provided during the PDU session establishment procedure, the S-NSSAI associated with T3584 or T3585, respectively is the S-NSSAI, including no S-NSSAI, provided by the UE during the PDU session establishment.

If the timer T3584 is provided during the PDU session modification or PDU session release procedure, the UE behaves as follows: The DNN associated with T3584 is the DNN provided by the UE during the PDU session establishment. If no S-NSSAI but DNN is provided by the UE along the PDU SESSION ESTABLISHMENT REQUEST message, then T3584 is associated with no S-NSSAI and the DNN provided to the network during the PDU session establishment. If the PDN connection was established when in the S1 mode, then T3584 is associated with no S-NSSAI. If no DNN but S-NSSAI is provided by the UE along the PDU SESSION ESTABLISHMENT REQUEST message, then T3584 is associated with no DNN and the S-NSSAI of the PDU session. If no DNN and no S-NSSAI is provided by the UE along the PDU SESSION ESTABLISHMENT REQUEST message, then T3584 is associated with no DNN and no S-NSSAI. For this purpose, the UE shall memorize the DNN and the S-NSSAI provided to the network during the PDU session establishment. The timer T3584 associated with no DNN and an S-NSSAI will never be started due to any 5GSM procedure related to an emergency PDU session. If the timer T3584 associated with no DNN and an S-NSSAI is running, it does not affect the ability of the UE to request an emergency PDU session.

If the timer T3585 was provided during the PDU session modification or PDU session release procedure, the UE behaves as follows: if an S-NSSAI was provided by the UE during the PDU session establishment, then T3585 is associated with the S-NSSAI of the PDU session. If no S-NSSAI is provided by the UE along the PDU SESSION ESTABLISHMENT REQUEST message, then T3585 is associated with no S-NSSAI. If the PDN connection was established when in the S1 mode, then T3585 is associated with no S-NSSAI.

If T3584 is running or is deactivated, then the UE is not allowed to initiate the:

a) PDU session establishment procedure;

b) PDU session modification procedure; or

c) NAS transport procedure for sending CIoT user data;

for the respective [S-NSSAI, no DNN] or [S-NSSAI, DNN] combination unless the UE is a UE configured for high priority access in selected PLMN or SNPN or to report a change of 3GPP PS data off UE status.

In a PLMN, if the timer T3584 is running or is deactivated for all the PLMNs and is associated with an S-NSSAI other than no S-NSSAI, then

a) the UE registered in the HPLMN is not allowed to initiate the:

   1) PDU session establishment procedure;

   2) PDU session modification procedure; or

   3) NAS transport procedure for sending CIoT user data;

when the [S-NSSAI, no DNN] or [S-NSSAI, DNN] combination provided by the UE during the PDU session establishment is the same as the [S-NSSAI, no DNN] or [S-NSSAI, DNN] combination associated with the timer T3584 unless the UE is a UE configured for high priority access in selected PLMN or to report a change of 3GPP PS data off UE status; and

b) the UE registered in a VPLMN is not allowed to initiate the:

1) PDU session establishment procedure;

2) PDU session modification procedure; or

3) NAS transport procedure for sending CIoT user data;

when the [mapped S-NSSAI, no DNN] or [mapped S-NSSAI, DNN] combination provided by the UE during the PDU session establishment is the same as the [S-NSSAI, no DNN] or [S-NSSAI, DNN] combination associated with the timer T3584 unless the UE is a UE configured for high priority access in selected PLMN or to report a change of 3GPP PS data off UE status.

In a PLMN, if the timer T3584 is running or is deactivated for all the PLMNs and is associated with [no S-NSSAI, no DNN] or [no S-NSSAI, DNN] combination, then the UE is not allowed to initiate the:

a) PDU session establishment procedure;

b) PDU session modification procedure; or

c) NAS transport procedure for sending CIoT user data;

for [no S-NSSAI, no DNN] or [no S-NSSAI, DNN] combination in any PLMN unless the UE is a UE configured for high priority access in selected PLMN or to report a change of 3GPP PS data off UE status.

In an SNPN, if the UE supports equivalent SNPNs, the timer T3584 is running or is deactivated for all the equivalent SNPNs, is associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, with an S-NSSAI other than no S-NSSAI, and with the RSNPN or an equivalent SNPN:

a) the UE registered in the subscribed SNPN is not allowed to initiate the:

1) PDU session establishment procedure; or

2) PDU session modification procedure;

when the [S-NSSAI, no DNN] or [S-NSSAI, DNN] combination provided by the UE during the PDU session establishment is the same as the [S-NSSAI, no DNN] or [S-NSSAI, DNN] combination associated with the timer T3584 unless the UE is a UE configured for high priority access in the RSNPN or to report a change of 3GPP PS data off UE status; and

b) the UE registered in a non-subscribed is not allowed to initiate the:

1) PDU session establishment procedure; or

2) PDU session modification procedure;

when the [mapped S-NSSAI, no DNN] or [mapped S-NSSAI, DNN] combination provided by the UE during the PDU session establishment is the same as the [S-NSSAI, no DNN] or [S-NSSAI, DNN] combination associated with the timer T3584 unless the UE is a UE configured for high priority access in RSNPN or to report a change of 3GPP PS data off UE status.

In an SNPN, if the UE supports equivalent SNPNs, the timer T3584 is running or is deactivated for all the equivalent SNPNs, is associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, with [no S-NSSAI, no DNN] or [no S-NSSAI, DNN] combination, and with the RSNPN or an equivalent SNPN, then the UE is not allowed to initiate the:

a) PDU session establishment procedure; or

b) PDU session modification procedure;

for [no S-NSSAI, no DNN] or [no S-NSSAI, DNN] combination unless the UE is a UE configured for high priority access in the RSPN or to report a change of 3GPP PS data off UE status.

If T3585 is running or is deactivated, then the UE is neither allowed to initiate the PDU session establishment procedure nor the PDU session modification procedure for the respective S-NSSAI unless the UE is a UE configured for high priority access in selected PLMN or SNPN or to report a change of 3GPP PS data off UE status.

In a PLMN, if the timer T3585 is running or is deactivated for all the PLMNs and is associated with an S-NSSAI other than no S-NSSAI, then

a) the UE registered in the HPLMN is not allowed to initiate the:

   1) PDU session establishment procedure;

   2) PDU session modification procedure; or

   3) NAS transport procedure for sending CIoT user data;

   when the S-NSSAI provided by the UE during the PDU session establishment is the same as the S-NSSAI associated with timer T3585 unless the UE is a UE configured for high priority access in selected PLMNs or to report a change of 3GPP PS data off UE status; and

b) the UE registered in a VPLMN is not allowed to initiate the:

   1) PDU session establishment procedure;

   2) PDU session modification procedure; or

   3) NAS transport procedure for sending CIoT user data;

   when the mapped S-NSSAI provided by the UE during the PDU session establishment is the same as the S-NSSAI associated the timer T3585 unless the UE is a UE configured for high priority access in selected PLMN or to report a change of 3GPP PS data off UE status.

In a PLMN, if the timer T3585 is running or is deactivated for all the PLMNs and is associated with no S-NSSAI, then the UE is not allowed to initiate the:

a) PDU session establishment procedure;

b) PDU session modification procedure;

c) NAS transport procedure for sending CIoT user data;

for no S-NSSAI in any PLMN unless the UE is a UE configured for high priority access in selected PLMN or to report a change of 3GPP PS data off UE status.In an SNPN, if the UE supports equivalent SNPNs, the timer T3585 is running or is deactivated for all the equivalent SNPNs, is associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, with an S-NSSAI other than no S-NSSAI, and with the RSNPN or an equivalent SNPN:

a) the UE registered in the subscribed SNPN is not allowed to initiate the:

   1) PDU session establishment procedure; or

   2) PDU session modification procedure;

   when the S-NSSAI provided by the UE during the PDU session establishment is the same as the S-NSSAI associated with timer T3585 unless the UE is a UE configured for high priority access in the RSNPN or to report a change of 3GPP PS data off UE status; and

b) the UE registered in a non-subscribed SNPN is not allowed to initiate the:

   1) PDU session establishment procedure; or

   2) PDU session modification procedure;

   when the mapped S-NSSAI provided by the UE during the PDU session establishment is the same as the S-NSSAI associated the timer T3585 unless the UE is a UE configured for high priority access in the RSNPN or to report a change of 3GPP PS data off UE status.

In an SNPN, if the UE supports equivalent SNPNs, the timer T3585 is running or is deactivated for all the equivalent SNPNs, is associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, with no S-NSSAI, and with the RSNPN or an equivalent SNPN, then the UE is not allowed to initiate the:

a) PDU session establishment procedure; or

b) PDU session modification procedure;

for no S-NSSAI unless the UE is a UE configured for high priority access in RSNPN or to report a change of 3GPP PS data off UE status.

If the network does not include timer T3584 with 5GSM cause #67 "insufficient resources for specific slice and DNN", the UE may use a local back-off timer that has exponential value or a default value, which is provisioned using implementation specific means, to:a) prevent sending any 5GSM procedure for the respective DNN and S-NSSAI till its expiry; andb) allow sending any 5GSM procedure for the respective DNN and S-NSSAI after its expiry.

If the network does not include timer T3585 with 5GSM cause #69 "insufficient resources for specific slice", the UE may use a local back-off timer that has exponential value or a default value, which is provisioned using implementation specific means, to:a) prevent sending any 5GSM procedure for the respective S-NSSAI till its expiry; and

b) allow sending any 5GSM procedure for the respective S-NSSAI after its expiry.

6.2.9 Interaction with upper layers

6.2.9.1 General

A 5GSM entity interacts with upper layers. Subclause 6.2.9.2 describes how the 5GSM entity interacts with upper layers with respect to the URSP. Subclause 6.2.9.3 describes how the 5GSM entity interacts with upper layers with respect to the ProSeP.

6.2.9.2 URSP

The URSP requires interaction between upper layers and the 5GSM entities in the UE (see 3GPP TS 24.526 [19] for further details). Each of the 5GSM entities in the UE shall indicate attributes (e.g. PDU session identity, SSC mode, S-NSSAI, DNN, PDU session type, access type, PDU address) of a newly established PDU session to the upper layers. If a PDU session is released, the 5GSM entity handling the PDU session shall inform the PDU session identity of the released PDU session to the upper layers. The upper layers may request a 5GSM entity:

a) to establish a PDU session indicating one or more PDU session attributes;

b) to release an existing PDU session; or

c) to establish a PDU session indicating one or more PDU session attributes, and to release an existing PDU session.

6.2.9.3 ProSeP

The ProSeP requires interaction between upper layers and the 5GSM entities in the UE acting as a 5G ProSe layer-3 UE-to-network relay UE (see 3GPP TS 24.554 [19E] for further details). The upper layers may request the 5GSM entity:

a) to establish a PDU session indicating one or more PDU session attributes; or

b) to release the existing PDU session; or

c) to establish a PDU session indicating one or more PDU session attributes, and to release the existing PDU session.

Each of the 5GSM entities in the UE acting as a 5G ProSe layer-3 UE-to-network relay UE shall indicate attributes (e.g. PDU session identity, SSC mode, S-NSSAI, DNN, PDU session type, access type, PDU address) of the newly

established PDU session to the upper layers. If the PDU session is released, the 5GSM entity handling the PDU session shall inform the PDU session identity of the released PDU session to the upper layers.

6.2.10 Handling of 3GPP PS data off

In case of PLMN, a UE, which supports 3GPP PS data off (see 3GPP TS 23.501 [8]), can be configured with up to two lists of 3GPP PS data off exempt services as specified in 3GPP TS 24.368 [17] or in the $EF_{3GPPPSDATAOFF}$ USIM file as specified in 3GPP TS 31.102 [22]:

a) a list of 3GPP PS data off exempt services to be used in the HPLMN or EHPLMN; and

b) a list of 3GPP PS data off exempt services to be used in the VPLMN.

If only the list of 3GPP PS data off exempt services to be used in the HPLMN or EHPLMN is configured at the UE, this list shall be also used in the VPLMN.

In case of SNPN, a UE, which supports 3GPP PS data off (see 3GPP TS 23.501 [8]), can be configured with:

a) up to two lists of 3GPP PS data off exempt services as specified in 3GPP TS 24.368 [17] for each subscribed SNPN whose entry exists in the "list of subscriber data":

   1) a list of 3GPP PS data off exempt services to be used in the subscribed SNPN; and

   2) a list of 3GPP PS data off exempt services to be used in the non-subscribed SNPN; and

b) one list of 3GPP PS data off exempt services as specified in 3GPP TS 24.368 [17] for PLMN subscription:

   1) a list of 3GPP PS data off exempt services to be used in the non-subscribed SNPN.

If only the list of 3GPP PS data off exempt services to be used in the subscribed SNPN is configured for the selected entry of "list of subscriber data", this list shall be also used in the non-subscribed SNPN.

If the UE supports 3GPP PS data off, the UE shall provide the 3GPP PS data off UE status in the Extended protocol configuration options IE during UE-requested PDU session establishment procedure except for the transfer of a PDU session from non-3GPP access to 3GPP access and except for the establishment of user plane resources on the other access for the MA PDU session(see subclause 6.4.1), and during UE-requested PDU session modification procedure (see subclause 6.4.2), regardless of associated access type of the PDU session. If the UE requests a PDU session establishment procedure in order to transfer a PDU session from non-3GPP access to 3GPP access, or in order to establish user plane resources on the other access for the MA PDU session over 3GPP access or non-3GPP access, and:

a) if the 3GPP PS data off UE status has changed since the last providing to the network, the UE shall provide the 3GPP PS data off UE status in the Extended protocol configuration options IE; or

b) if the 3GPP PS data off UE status has not changed since the last providing to the network, the UE need not provide the 3GPP PS data off UE status.

The network shall support of 3GPP PS data off.

The UE shall indicate change of the 3GPP PS data off UE status for the PDU session by using the UE-requested PDU session modification procedure as specified in subclause 6.4.2.

When the 3GPP PS data off UE status is "activated":

a) the UE does not send uplink IP packets via 3GPP access except:

   1) for those services indicated in the list of 3GPP PS data off exempt services to be used in the HPLMN or EHPLMN as specified in 3GPP TS 24.368 [17] when the UE is in its HPLMN or EHPLMN;

   2) for those services indicated in the list of 3GPP PS data off exempt services to be used in the subscribed SNPN, configured for the selected entry of "list of subscriber data", as specified in 3GPP TS 24.368 [17] when the UE is in the subscribed SNPN;

   3) for those services indicated in the list of 3GPP PS data off exempt services to be used in the HPLMN or EHPLMN when the UE is in the VPLMN, if only the list of 3GPP PS data off exempt services to be used in the HPLMN or EHPLMN is configured to the UE as specified in 3GPP TS 24.368 [17];

4) for those services indicated in the list of 3GPP PS data off exempt services to be used in the subscribed SNPN, configured for the selected entry of "list of subscriber data", when the UE is in a non-subscribed SNPN and only the list of 3GPP PS data off exempt services to be used in the subscribed SNPN is configured for the selected entry of "list of subscriber data" as specified in 3GPP TS 24.368 [17];

5) for those services indicated in the list of 3GPP PS data off exempt services to be used in the VPLMN when the UE is in the VPLMN, if the list of 3GPP PS data off exempt services to be used in the VPLMN is configured to the UE as specified in 3GPP TS 24.368 [17];

6) for those services indicated in the list of 3GPP PS data off exempt services to be used in the non-subscribed SNPN, configured for the selected entry of "list of subscriber data", when the UE is in a non-subscribed SNPN and the list of 3GPP PS data off exempt services to be used in the non-subscribed SNPN is configured for the selected entry of "list of subscriber data" as specified in 3GPP TS 24.368 [17];

7) for those services indicated in the list of 3GPP PS data off exempt services to be used in the non-subscribed SNPN, configured for the selected PLMN subscription, when the UE is in the non-subscribed SNPN and the list of 3GPP PS data off exempt services to be used in the non-subscribed SNPN is configured for the selected PLMN subscription as specified in 3GPP TS 24.368 [17];

8) for those services indicated in the $EF_{3GPPPSDATAOFF}$ USIM file as specified in 3GPP TS 31.102 [22];

9) any uplink traffic due to procedures specified in 3GPP TS 24.229 [14]; and

10) any uplink traffic due to procedures specified in 3GPP TS 24.623 [20];

b) the UE does not send uplink Ethernet user data packets via 3GPP access; and

c) the UE does not send uplink Unstructured user data packets via 3GPP access.

Otherwise the UE sends uplink user data packets without restriction.

NOTE: If the UE supports 3GPP PS data off, uplink IP packets are filtered as specified in 3GPP TS 24.229 [14] in U.3.1.5.

3GPP PS data off does not restrict sending of uplink user data packets via non-3GPP access of a single access PDU session or an MA PDU session.

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 an 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, the PDU session is of "IPv6" or "IPv4v6" PDU session type, and the UE has not previously successfully performed the UE-requested PDU session modification to provide this indication.

6.2.12 Handling of network rejection not due to congestion control

The network may include a back-off timer value in a 5GS session management reject message to regulate the time interval at which the UE may retry the same procedure for 5GSM cause values other than #26 "insufficient resources", #28 "unknown PDU session type", #39 "reactivation requested", #46 "out of LADN service area", #50 "PDU session type IPv4 only allowed", #51 "PDU session type IPv6 only allowed", #54 "PDU session does not exist", #57 "PDU session type IPv4v6 only allowed", #58 "PDU session type Unstructured only allowed", #61 "PDU session type Ethernet only allowed", #67 "insufficient resources for specific slice and DNN", #68 "not supported SSC mode" and

#69 "insufficient resources for specific slice". For 5GSM cause values other than #26 "insufficient resources", #28 "unknown PDU session type", #39 "reactivation requested", #46 "out of LADN service area", #54 "PDU session does not exist", #67 "insufficient resources for specific slice and DNN", #68 "not supported SSC mode", and #69 "insufficient resources for specific slice", and #86 "UAS services not allowed", the network may also include the re-attempt indicator to indicate whether the UE is allowed to re-attempt the corresponding session management procedure for the same DNN in S1 mode after inter-system change.

NOTE 1: In a PLMN, if the network includes this back-off timer value for 5GSM cause values other than #27 "missing or unknown DNN", then the UE is blocked from sending another 5GSM request for the same procedure for the same [PLMN, DNN, S-NSSAI], [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, S-NSSAI], or [PLMN, no DNN, no S-NSSAI] combination for the specified duration. If the network includes this back-off timer value for 5GSM cause value #27 "missing or unknown DNN", then the UE is blocked from sending another 5GSM request for the same procedure for the same [PLMN, DNN], or [PLMN, no DNN] combination for the specified duration. In an SNPN, if the network includes this back-off timer value for 5GSM cause values other than #27 "missing or unknown DNN", then the UE is blocked from sending another 5GSM request for the same procedure for the same [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, S-NSSAI], [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, S-NSSAI], or [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] combination for the specified duration. If the network includes this back-off timer value for 5GSM cause value #27 "missing or unknown DNN", then the UE is blocked from sending another 5GSM request for the same procedure for the same [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN], or [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN] combination for the specified duration. Therefore, the operator needs to exercise caution in determining the use of this timer value.

NOTE 2: If the re-attempt indicator is not provided by the network, a UE registered in its HPLMN or in an EHPLMN can use the configured SM_RetryAtRATChange value specified in the NAS configuration MO or in the USIM NAS_{CONFIG} file to derive the re-attempt indicator as specified in subclauses 6.4.1.4.3 and 6.4.2.4.3.

If re-attempt in S1 mode is allowed for 5GSM cause values other than #27 "missing or unknown DNN", the UE shall consider the back-off timer to be applicable only to the 5GS session management in N1 mode for the rejected 5GS session management procedure and the given [PLMN, DNN, S-NSSAI], [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, S-NSSAI], or [PLMN, no DNN, no S-NSSAI] combination. If re-attempt in S1 mode is allowed for 5GSM cause value #27 "missing or unknown DNN", the UE shall consider the back-off timer to be applicable only to the 5GS session management in N1 mode for the rejected 5GS session management procedure and the given [PLMN, DNN], or [PLMN, no DNN] combination.If re-attempt in S1 mode is not allowed, the UE shall consider the back-off timer to be applicable to both NAS protocols, i.e. applicable to the 5GS session management in N1 mode for the rejected 5GS session management procedure and to the EPS session management in S1 mode for the corresponding session management procedure and the given [PLMN, DNN] or [PLMN, no DNN] combination.

NOTE 3: In the present subclause the terms DNN and APN are referring to the same parameter.

In a PLMN, if the back-off timer was provided during the PDU session establishment procedure, the UE behaves as follows: for 5GSM cause values other than #27 "missing or unknown DNN", when the UE is registered in a HPLMN, the DNN and the S-NSSAI of the [PLMN, DNN, S-NSSAI] combination associated with the back-off timer is the DNN and the S-NSSAI provided by the UE when the PDU session is established. When the UE is registered in a VPLMN, the DNN and the S-NSSAI of the [PLMN, DNN, S-NSSAI] combination associated with the back-off timer is the DNN and the mapped S-NSSAI provided by the UE when the PDU session is established. For 5GSM cause value #27 "missing or unknown DNN", the DNN of the [PLMN, DNN] combination associated with the back-off timer is the DNN provided by the UE when the PDU session is established. If no DNN or no S-NSSAI was provided to the network during the PDU session establishment, then the back-off timer is associated with the [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, S-NSSAI], or [PLMN, no DNN, no S-NSSAI] combination, dependent on which parameters were provided for 5GSM cause values other than #27 "missing or unknown DNN". If no DNN was provided to the network during the PDU session establishment, then the back-off timer is associated with the [PLMN, no DNN] combination for 5GSM cause value #27 "missing or unknown DNN". For this purpose, the UE shall memorize the DNN and the S-NSSAI provided to the network during the PDU session establishment.

In a PLMN, if the back-off timer was provided during the PDU session modification procedure, the UE behaves as follows: the DNN associated with the back-off timer is the DNN, including no DNN, provided by the UE when the PDU session is established. If an S-NSSAI was provided by the UE during the PDU session establishment, when the

UE is registered in a HPLMN, then the S-NSSAI associated with the back-off timer is the S-NSSAI of the PDU session. If an S-NSSAI was provided by the UE during the PDU session establishment, when the UE is registered in a VPLMN, then the S-NSSAI associated with the back-off timer is the mapped S-NSSAI of the PDU session. If no S-NSSAI was provided by the UE during the PDU session establishment, then the back-off timer is associated with no S-NSSAI. For this purpose, the UE shall memorize the DNN and the S-NSSAI provided to the network during the PDU session establishment.

In a PLMN, the back-off timer associated with the [PLMN, no DNN, no S-NSSAI], or [PLMN, no DNN] combination will never be started due to any 5GSM procedure related to an emergency PDU session. If the back-off timer associated with the [PLMN, no DNN, no S-NSSAI], or [PLMN, no DNN] combination is running, it does not affect the ability of the UE to request an emergency PDU session.

In an SNPN, the back-off timer associated with the [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI], or [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN] combination will never be started due to any 5GSM procedure related to an emergency PDU session. If the back-off timer associated with the back-off timer associated with the [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI], or [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN] combination, it does not affect the ability of the UE to request an emergency PDU session.

In a PLMN, the network may additionally indicate in the re-attempt indicator that a command to back-off is applicable not only for the PLMN in which the UE received the 5GS session management reject message, but for each PLMN included in the equivalent PLMN list at the time when the 5GS session management reject message was received.

In an SNPN, the network may additionally indicate in the re-attempt indicator that a command to back-off is applicable not only for the SNPN in which the UE received the 5GS session management reject message, but for each SNPN included in the equivalent SNPN list at the time when the 5GS session management reject message was received.

In a PLMN, if the back-off timer is running or is deactivated for a given [PLMN, DNN, S-NSSAI], [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, S-NSSAI], [PLMN, no DNN, no S-NSSAI], [PLMN, DNN], or [PLMN, no DNN] combination, and the UE is a UE configured for high priority access in selected PLMN, then the UE is allowed to initiate 5GSM procedures for the [PLMN, DNN, S-NSSAI], [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, S-NSSAI], [PLMN, no DNN, no S-NSSAI], [PLMN, DNN], or [PLMN, no DNN] combination.

In an SNPN, if the back-off timer is running or is deactivated for a given [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, S-NSSAI], [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, S-NSSAI], [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI], [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN], or [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN] combination if the UE is a UE configured for high priority access in selected SNPN, then the UE is allowed to initiate 5GSM procedures for the [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, S-NSSAI], [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, S-NSSAI], [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI], [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN], or [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN] combination.

The RATC bit in the re-attempt indicator IE and its derivation shall not be applicable in an SNPN.

If the network does not include a back-off timer with 5GSM cause #29 "insufficient resources", #31 "request rejected, unspecified", and #38 "network failure", the UE may use a local back-off timer that has exponential value or a default value, which is provisioned using implementation specific means, to:a) prevent sending the rejected 5GSM procedure for the respective DNN till its expiry; and

b) allow sending the rejected 5GSM procedure for the respective DNN after its expiry.

6.2.13 Handling of Small data rate control

Small data rate control is applicable only to NB-N1 mode and WB-N1 mode.

Small data rate control controls the maximum number of uplink user data messages including uplink exception data reporting sent by the UE in a time interval for the PDU session in accordance with 3GPP TS 23.501 [8]. The UE shall

limit the rate at which it generates uplink user data messages to comply with the small data rate control policy. The NAS shall provide the indicated rates to upper layers for enforcement. The indicated rates in a NAS procedure applies to the PDU session the NAS procedure corresponds to, and the indicated rates are valid until a new value is indicated or the PDU session is released.

If the UE indicates support for CIoT 5GS optimizations, the network may provide the small data rate control parameters to the UE and may provide the small data rate control parameters for exception data to the UE if and only if the small data rate control parameters is provided to the UE. Small data rate control parameters and small data rate control parameters for exception data can also be provided to the UE in S1 mode as specified in 3GPP TS 24.301 [15].

If an allowed indication of additional exception reports is provided with the small data rate control parameters and:

- the additional small data rate control parameters for exception data is provided and the limit for additional rate for exception data reporting is not reached; or

- the additional small data rate control parameters for exception data is not provided,

the UE is allowed to send uplink exception reports even if the limit for the small data rate control has been reached.

During a PDU session release procedure, if the small data rate control was applied to the PDU session that is being released, the network may store the small data rate control status for the released PDU session as specified in 3GPP TS 23.501 [8].

If:

a) the UE indicates support for CIoT 5GS optimizations; and

b) the small data rate control status was stored for the PDU session and is still valid,

the network may provide the remaining small data rate control status as initial small data rate control parameters to the UE and initial small data rate control parameters for exception data to the UE during a subsequent PDU session establishment procedure.

If received during the establishment of a PDU session, the UE shall apply the initial small data rate control parameters and the initial small data rate control parameters for exception data for the duration of the validity period. When the validity period expires the small data rate control parameters and the small data rate control parameters for exception data shall be applied (see 3GPP TS 23.501 [8]).

NOTE 1: The HPLMN can discard or delay user data that exceeds the limit provided for small data rate control.

Upon inter-system change from N1 mode to S1 mode, the UE shall store the current small data rate control status for PDU sessions to be transferred from N1 mode to S1 mode as specified in 3GPP TS 23.501 [8].

NOTE 2: How long the UE stores the current small data rate control status is implementation specific.

Upon inter-system change from S1 mode to N1 mode, the UE shall use the stored small data rate control status, if any, to comply with the small data rate control policy for PDU sessions transferred from S1 mode to N1 mode as specified in 3GPP TS 23.501 [8], if the validity period of the stored small data rate control status has not expired.

6.2.14 Handling of Serving PLMN rate control

Serving PLMN rate control is applicable only for PDU sessions established for control plane CIoT 5GS optimization.

Serving PLMN rate control protect its AMF from the load generated by user data over control plane.

The SMF can inform the UE of any local serving PLMN rate control during the PDU session establishment procedure (see subclause 6.4.1) or the PDU session modification procedure (see subclause 6.4.2). If serving PLMN rate control is enabled, the SMF shall start the serving PLMN rate control for the PDU session when the first control plane user data is received over the PDU session.The UE shall limit the rate at which it generates uplink control plane user data to comply with the serving PLMN policy provided by the network. The indicated rate in a NAS procedure applies to the PDU session the NAS procedure corresponds to, and the indicated rate is valid until the PDU session is released.

Any Serving PLMN rate control information provided by the network to the UE is only applicable for the PLMN which provided this information. This serving PLMN rate control information shall be discarded when the UE successfully registers to another PLMN.

NOTE: The serving PLMN can discard or delay control plane user data that exceed the limit provided for Serving PLMN rate control.

6.2.15 Handling of Reliable Data Service

If the UE supports Reliable Data Service (see 3GPP TS 23.501 [8] and 3GPP TS 24.250 [14A]), the UE may request data transfer using Reliable Data Service for a PDU session in the Extended protocol configuration options IE during UE-requested PDU session establishment procedure (see subclause 6.4.1).

The Reliable Data Service may only be used with PDU sessions for which the "Control Plane CIoT 5GS Optimisation" indicator is set or with PDU sessions using the control plane CIoT 5GS optimization when the AMF does not move such PDU sessions to the user plane.

The network shall inform the UE about the acceptance of UE's request for Reliable Data Service usage during the PDU session establishment procedure (see subclause 6.4.1) in the Extended protocol configuration options IE.

If the network accepts the use of Reliable Data Service to transfer data for the specified PDU session, the UE shall use this PDU session exclusively for data transfer using Reliable Data Service; otherwise the UE shall not use this PDU session for data transfer using Reliable Data Service.

6.2.16 Handling of header compression for control plane CIoT optimizations

The UE and the SMF may use:

- IP header compression for PDU sessions of "IPv4", "IPv6" or "IPv4v6" PDU session type; and
- Ethernet header compression for PDU sessions of "Ethernet" PDU session type.

Both the UE and the AMF indicate whether header compression for control plane CIoT 5GS optimization is supported during registration procedures (see subclause 5.5.1). If both the UE and the network support header compression, the header compression configuration for each PDU session is negotiated during the PDU session establishment procedure and PDU session modification procedure as specified in subclauses 6.3.2, 6.4.1 and 6.4.2.

For IP header compression, ROHC protocol specified in IETF RFC 5795 [39B] is used. The IP header compression configuration used for IP header compression is (re-)negotiated between the UE and the SMF using the IP header compression configuration IE as specified in subclauses 6.3.2.2, 6.4.1.2, 6.4.1.3 and 6.4.2.2, respectively.

For Ethernet header compression, Ethernet Header Compression (EHC) protocol specified in 3GPP TS 38.323 [29] is used. The Ethernet header compression configuration used for Ethernet header compression is (re-)negotiated between the UE and the SMF using the Ethernet header compression configuration IE as specified in subclauses 6.3.2.2, 6.4.1.2, 6.4.1.3 and 6.4.2.2, respectively.

6.2.17 Handling of edge computing enhancements

EAS discovery, EAS rediscovery and ECS address provisioning provide enhanced edge computing support in 5GS (see 3GPP TS 23.548 [10A]).

If the network supports the session breakout connectivity model or distributed anchor connectivity model to enable edge computing enhancements and the UE generated DNS message is to be handled by an edge application server discovery function (EASDF) for EAS discovery as specified in 3GPP TS 23.548 [10A], the SMF selects the EASDF and it provides its IP address to the UE as the DNS server to be used for the PDU session in the Extended protocol configuration options IE during the UE-requested PDU session establishment procedure as described in subclause 6.4.1.3.

NOTE 1: EASDF selection is outside the scope of the present document.

If the network supports the session breakout connectivity model to enable edge computing enhancements and the UE generated DNS message is to be handled by a local DNS server for EAS discovery as specified in 3GPP TS 23.548 [10A], the SMF selects the local DNS server, obtains its IP address and can provide the IP address of the local DNS server to the UE as the DNS server to be used for the PDU session in the Extended protocol

configuration options IE during the UE-requested PDU session establishment procedure or the network-requested PDU session modification procedure as described in subclauses 6.4.1.3 and 6.3.2.2, respectively.

NOTE 2: Local DNS server selection and the acquisition of its IP address is outside the scope of the present document.

If the UE supports EAS rediscovery and the SMF decides to trigger the EAS rediscovery as specified in 3GPP TS 23.548 [10A], the SMF initiates a network-requested PDU session modification procedure to provide the EAS rediscovery information to the UE as described in subclauses 6.3.2.2. Upon receipt of the EAS rediscovery information, the UE provides the received information to the upper layers.

NOTE 3: The upper layers of the UE uses the EAS rediscovery information to trigger the EAS discovery procedure to get the new EAS information as specified in 3GPP TS 23.548 [10A].

If the UE supports ECS address provisioning over NAS as specified in 3GPP TS 23.548 [10A], the UE indicates its support of ECS configuration information provisioning over NAS in the Extended protocol configuration options IE either during the UE-requested PDU session establishment procedure as described in subclause 6.4.1.2 or while in S1 mode as described in 3GPP TS 24.301 [15], respectively.

If the UE indicated support of ECS configuration information address provisioning over NAS, the SMF can provide the ECS configuration information in the Extended protocol configuration options IE during the network-requested PDU session modification procedure, UE-requested PDU session establishment procedure or the UE-requested PDU session modification procedure as described in subclauses 6.3.2.2, 6.4.1.3 and 6.4.2.3, respectively.

NOTE 4: The SMF can obtain the ECS configuration information based on the local configuration, the UE's location, the UE's subscription information, or any combination of them.

If the UE supports the edge DNS client (EDC) as specified in 3GPP TS 23.548 [10A], the UE indicates its support of EDC in the Extended protocol configuration options IE during the UE-requested PDU session establishment procedure as described in subclause 6.4.1.2 or the UE-requested PDU session modification procedure as described in subclause 6.4.2.2.

If the UE indicates support of EDC, the SMF can indicate in the Extended protocol configuration options IE during the UE-requested PDU session establishment procedure as described in subclause 6.4.1.3 or the network-requested PDU session modification procedure as described in subclause 6.3.2.2, that the network allows the use of EDC for the applications which are mapped onto the PDU session and explicitly requested the use of EDC, or that the network requires the use of EDC for all applications mapped onto the PDU session.

6.2.18 Support of redundant PDU sessions

The 5GSM sublayer may support establishment of redundant PDU sessions (see subclause 5.33.2 of 3GPP TS 23.501 [8]).

In order to establish a set of two redundant PDU sessions, a UE can include a PDU session pair ID, an RSN, or both in a PDU SESSION ESTABLISHMENT REQUEST message for each of the two redundant PDU sessions (see subclause 6.4.1.2). The UE can set the PDU session pair ID, the RSN, or both according to URSP or UE local configuration (see 3GPP TS 24.526 [19]).

An SMF receiving a PDU session pair ID, an RSN, or both via a PDU SESSION ESTABLISHMENT REQUEST message operates as specified in subclause 5.33.2 of 3GPP TS 23.501 [8]. In addition, an SMF can handle two PDU sessions as redundant even if the UE provides neither a PDU session pair ID nor an RSN in a PDU SESSION ESTABLISHMENT REQUEST message for each of the PDU sessions (see subclause 5.33.2 of 3GPP TS 23.501 [8]).

6.2.19 Handling of maximum group data rate limitation control

The network can perform maximum group data rate limitation control to 5G VN groups as specified in 3GPP TS 23.503 [10]. If the maximum data rate of PDU sessions associated within a 5G VN group has been exceeded the maximum group data rate of the 5G VN group, the SMF may reject the PDU SESSION ESTABLISHMENT REQUEST message against the 5G VN group using S-NSSAI based congestion control as specified in subclause 6.2.8 and 6.4.1.4.2.

NOTE 1: The maximum group data rate limitation control does not apply for emergency services or for a UE configured for high priority access in selected PLMN or SNPN.

NOTE 2: The maximum group data rate limitation control is performed by the PCF.

6.2.20 Support of UL PDU set handling

If the network supports PDU set handling (see subclause 5.37.5 of 3GPP TS 23.501 [8]), based on operator policy, the SMF may provide the protocol description for UL PDU set handling in the PDU SESSION ESTABLISHMENT ACCEPT message or the PDU SESSION MODIFICATION COMMAND message to the UE. The UE can store the protocol description and may use it to identify PDUs belong to PDU sets for the uplink direction.

NOTE 1: Whether and how to use the protocol description to identify PDUs belonging to a PDU set in the uplink direction, is up to UE implementation. The use of protocol description does not impact UL user data packet matching in the UE.

NOTE 2: Whether and how to process PDUs belonging to a PDU set in the uplink direction, is up to UE implementation.

6.3 Network-requested 5GSM procedures

6.3.1 PDU session authentication and authorization procedure

6.3.1.1 General

The purpose of the PDU session authentication and authorization procedure is to enable the DN:

a) to authenticate the upper layers of the UE, when establishing the PDU session;

b) to authorize the upper layers of the UE, when establishing the PDU session;

c) both of the above; or

d) to re-authenticate the upper layers of the UE after establishment of the PDU session.

The PDU session authentication and authorization procedure can be performed only during or after the UE-requested PDU session procedure establishing a non-emergency PDU session. The PDU session authentication and authorization procedure shall not be performed during or after the UE-requested PDU session establishment procedure establishing an emergency PDU session.

The upper layers store the association between a DNN and corresponding credentials, if any, for the PDU session authentication and authorization.

If the UE is registered for onboarding services in SNPN the SMF may initiate the PDU session authentication and authorization procedure based on local policy with a DCS as specified in 3GPP TS 33.501 [24] subclause I.9.2.4.1 or a DN-AAA server as specified in 3GPP TS 33.501 [24] subclause I.9.2.4.2.

If the UE is registered for onboarding services in SNPN and the network initiates the PDU session authentication and authorization procedure, the UE shall use the default UE credentials for secondary authentication for the PDU session authentication and authorization procedure.

The network authenticates the UE using the Extensible Authentication Protocol (EAP) as specified in IETF RFC 3748 [34].

EAP has defined four types of EAP messages:

a) an EAP-request message;

b) an EAP-response message;

c) an EAP-success message; and

d) an EAP-failure message.

The EAP-request message is transported from the network to the UE using the PDU SESSION AUTHENTICATION COMMAND message of the PDU EAP message reliable transport procedure.

The EAP-response message to the EAP-request message is transported from the UE to the network using the PDU SESSION AUTHENTICATION COMPLETE message of the PDU EAP message reliable transport procedure.

If the PDU session authentication and authorization procedure is performed during the UE-requested PDU session establishment procedure:

a) and the DN authentication of the UE completes successfully, the EAP-success message is transported from the network to the UE as part of the UE-requested PDU session establishment procedure in the PDU SESSION ESTABLISHMENT ACCEPT message.

b) and the DN authentication of the UE completes unsuccessfully, the EAP-failure message is transported from the network to the UE as part of the UE-requested PDU session establishment procedure in the PDU SESSION ESTABLISHMENT REJECT message.

If the PDU session authentication and authorization procedure is performed after the UE-requested PDU session establishment procedure:

a) and the DN authentication of the UE completes successfully, the EAP-success message is transported from the network to the UE using the PDU SESSION AUTHENTICATION RESULT message of the PDU EAP result message transport procedure.

b) and the DN authentication of the UE completes unsuccessfully, the EAP-failure message is transported from the network to the UE using the PDU SESSION RELEASE COMMAND message of the network-requested PDU session release procedure.

There can be several rounds of exchange of an EAP-request message and a related EAP-response message for the DN to complete the authentication and authorization of the request for a PDU session (see example in figure 6.3.1.1).

The SMF shall set the authenticator retransmission timer specified in IETF RFC 3748 [34] subclause 4.3 to infinite value.

NOTE: The PDU session authentication and authorization procedure provides a reliable transport of EAP messages and therefore retransmissions at the EAP layer of the SMF do not occur.

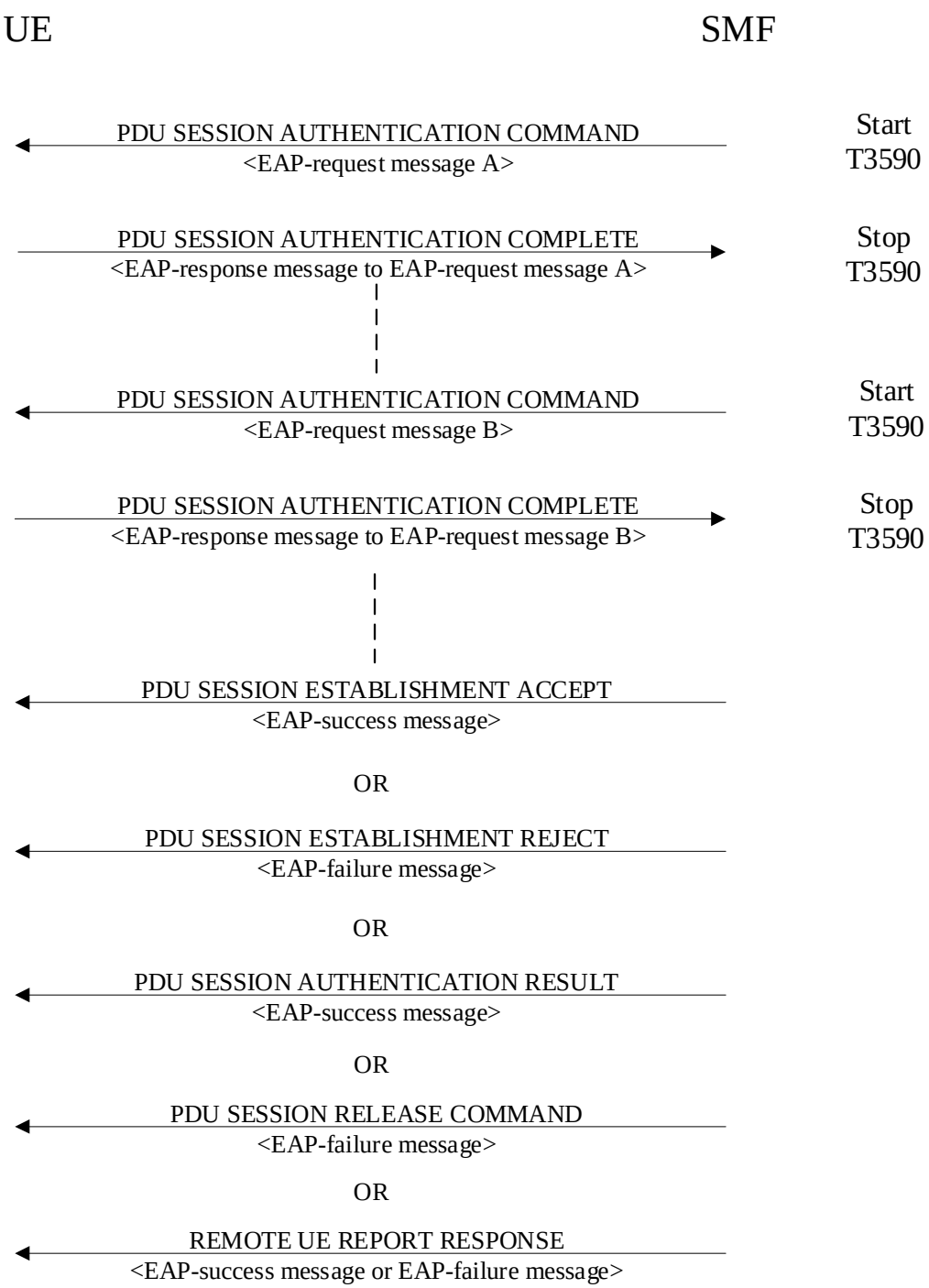


Figure 6.3.1.1: PDU session authentication and authorization procedure

6.3.1.2 PDU EAP message reliable transport procedure

6.3.1.2.1 PDU EAP message reliable transport procedure initiation

In order to initiate the PDU EAP message reliable transport procedure, the SMF shall create a PDU SESSION AUTHENTICATION COMMAND message.

The SMF shall set the PTI IE of the PDU SESSION AUTHENTICATION COMMAND message to "No procedure transaction identity assigned".

The SMF shall set the EAP message IE of the PDU SESSION AUTHENTICATION COMMAND message to the EAP-request message provided by the DN or generated locally.

The SMF shall send the PDU SESSION AUTHENTICATION COMMAND message, and the SMF shall start timer T3590 (see example in figure 6.3.1.1).

Upon receipt of the PDU SESSION AUTHENTICATION COMMAND message, if the UE provided a DNN during the PDU session establishment, the UE shall stop timer T3396, if it is running for the DNN provided by the UE. If the UE did not provide a DNN during the PDU session establishment, the UE shall stop the timer T3396 associated with no DNN if it is running. In an SNPN, the timer T3396 to be stopped includes:

a) the timer T3396 applied for all the equivalent SNPNs, associated with the RSNPN or an equivalent SNPN, and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

b) the timer T3396 applied for the registered SNPN, associated with the RSNPN, and, if the UE supports access to an SNPN using credentials from a credentials holder, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

Upon receipt of the PDU SESSION AUTHENTICATION COMMAND message, if the UE provided an S-NSSAI and a DNN during the PDU session establishment, the UE shall stop timer T3584, if it is running for the [S-NSSAI of the PDU session, DNN] combination. If the UE provided a DNN but did not provide an S-NSSAI during the PDU session establishment, the UE shall stop timer T3584, if it is running for the same [no S-NSSAI, DNN] combination provided by the UE. If the UE provided an S-NSSAI but did not provide a DNN during the PDU session establishment, the UE shall stop timer T3584, if it is running for the same [S-NSSAI, no DNN] combination provided by the UE. If the UE provided neither a DNN nor an S-NSSAI during the PDU session establishment, the UE shall stop timer T3584, if it is running for the same [no S-NSSAI, no DNN] combination provided by the UE. The timer T3584 to be stopped includes:

a) in a PLMN:

   1) the timer T3584 applied for all the PLMNs, if running; and

   2) the timer T3584 applied for the registered PLMN, if running; or

b) in an SNPN:

   1) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

   2) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

Upon receipt of the PDU SESSION AUTHENTICATION COMMAND message, if the UE provided an S-NSSAI during the PDU session establishment, the UE shall stop timer T3585, if it is running for the S-NSSAI of the PDU session. If the UE did not provide an S-NSSAI during the PDU session establishment, the UE shall stop the timer T3585 associated with no S-NSSAI if it is running. The timer T3585 to be stopped includes:

a) in a PLMN:

   1) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, if running;

   2) the timer T3585 applied for all the PLMNs and for both 3GPP access type and non-3GPP access type, if running;

   3) the timer T3585 applied for the registered PLMN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, if running; and

   4) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, if running; or

b) in an SNPN:

1) the timer T3585 applied for all the equivalent SNPNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

2) the timer T3585 applied for all the equivalent SNPNs and for both 3GPP access type and non-3GPP access type, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

3) the timer T3585 applied for the registered SNPN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

4) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

NOTE 1: Upon receipt of the PDU SESSION AUTHENTICATION COMMAND message for a PDU session, if the UE provided a DNN (or no DNN) and an S-NSSAI (or no S-NSSAI) when the PDU session is established, timer T3396 associated with the DNN (or no DNN, if no DNN was provided by the UE) is running, and timer T3584 associated with the DNN (or no DNN, if no DNN was provided by the UE) and the S-NSSAI (or no S-NSSAI, if no S-NSSAI was provided by the UE) is running, then the UE stops both the timer T3396 and the timer T3584.

NOTE 2: Upon receipt of the PDU SESSION AUTHENTICATION COMMAND message for a PDU session, if the UE provided a DNN (or no DNN) and an S-NSSAI (or no S-NSSAI) when the PDU session is established, timer T3585 associated with the S-NSSAI (or no S-NSSAI, if no S-NSSAI was provided by the UE) is running, and timer T3584 associated with the DNN (or no DNN, if no DNN was provided by the UE) and the S-NSSAI (or no S-NSSAI, if no S-NSSAI was provided by the UE) is running, then the UE stops both the timer T3585 and the timer T3584.

Upon receipt of a PDU SESSION AUTHENTICATION COMMAND message and a PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5, the UE passes to the upper layers the EAP message received in the EAP message IE of the PDU SESSION AUTHENTICATION COMMAND message. Apart from this action and the stopping of timers T3396, T3584 and T3485 (if running), the authentication and authorization procedure initiated by the DN is transparent to the 5GSM layer of the UE.

6.3.1.2.2 PDU EAP message reliable transport procedure accepted by the UE

The UE shall create a PDU SESSION AUTHENTICATION COMPLETE message when the upper layers provide an EAP-response message responding to the received EAP-request message.

The UE shall set the EAP message IE of the PDU SESSION AUTHENTICATION COMPLETE message to the EAP-response message.

The UE shall transport the PDU SESSION AUTHENTICATION COMPLETE message and the PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5. Apart from this action, the authentication and authorization procedure initiated by the DN is transparent to the 5GSM layer of the UE.

Upon receipt of a PDU SESSION AUTHENTICATION COMPLETE message, the SMF shall stop timer T3590 and provides the EAP message received in the EAP message IE of the PDU SESSION AUTHENTICATION COMPLETE message to the DN or handles it locally.

6.3.1.2.3 Abnormal cases on the network side

The following abnormal cases can be identified:

a) T3590 expired.

The SMF shall, on the first expiry of the timer T3590, retransmit the PDU SESSION AUTHENTICATION COMMAND message and shall reset and start timer T3590. This retransmission is repeated four times, i.e. on the fifth expiry of timer T3590, the SMF shall abort the procedure.

b) Collision of UE-requested PDU session release procedure and a PDU session authentication and authorization procedure.

When the SMF receives a PDU SESSION RELEASE REQUEST message during the PDU session authentication and authorization procedure, and the PDU session indicated in the PDU SESSION RELEASE REQUEST message is the PDU session that the SMF had requested to authenticate, the SMF shall abort the PDU session authentication and authorization procedure and proceed with the UE-requested PDU session release procedure.

6.3.1.2.4 Abnormal cases in the UE

The following abnormal cases can be identified:

a) PDU session inactive for the received PDU session ID.

If the PDU session ID in the PDU SESSION AUTHENTICATION COMMAND message belongs to any PDU session in state PDU SESSION INACTIVE in the UE, the UE shall send a 5GSM STATUS message with the 5GSM cause IE set to #43 "Invalid PDU session identity".

b) Collision of UE-requested PDU session release procedure and a PDU session authentication and authorization procedure.

When the UE receives a PDU SESSION AUTHENTICATION COMMAND message during the UE-requested PDU session release procedure, and the PDU session indicated in PDU SESSION AUTHENTICATION COMMAND message is the PDU session that the UE had requested to release, the UE shall ignore the PDU SESSION AUTHENTICATION COMMAND message and proceed with the UE-requested PDU session release procedure.

6.3.1.3 PDU EAP result message transport procedure

6.3.1.3.1 PDU EAP result message transport procedure initiation

PDU EAP result message transport procedure is initiated by the SMF if the PDU session authentication and authorization procedure is performed after the PDU session is established and the DN authentication of the UE completes successfully.

In order to initiate the PDU EAP result message transport procedure, the SMF shall create a PDU SESSION AUTHENTICATION RESULT message.

The SMF shall set the PTI IE of the PDU SESSION AUTHENTICATION RESULT message to "No procedure transaction identity assigned".

The SMF shall set the EAP message IE of the PDU SESSION AUTHENTICATION RESULT message to the EAP-success message provided by the DN.

The SMF shall send the PDU SESSION AUTHENTICATION RESULT message.

Upon receipt of a PDU SESSION AUTHENTICATION RESULT message and a PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5, the UE passes to the upper layers the EAP message received in the EAP message IE of the PDU SESSION AUTHENTICATION RESULT message. Apart from this action, the authentication and authorization procedure initiated by the DN is transparent to the 5GSM layer of the UE.

6.3.1.3.2 Abnormal cases in the UE

The following abnormal cases can be identified:

a) PDU session inactive for the received PDU session ID.

If the PDU session ID in the PDU SESSION AUTHENTICATION RESULT message belongs to any PDU session in state PDU SESSION INACTIVE in the UE, the UE shall send a 5GSM STATUS message with the 5GSM cause IE set to #43 "Invalid PDU session identity".

b) Collision of UE-requested PDU session release procedure and a PDU EAP result message transport procedure.

When the UE receives a PDU SESSION AUTHENTICATION RESULT message during the UE-requested PDU session release procedure, and the PDU session indicated in PDU SESSION AUTHENTICATION RESULT message is the PDU session that the UE had requested to release, the UE shall ignore the PDU SESSION AUTHENTICATION RESULT message and proceed with the UE-requested PDU session release procedure.

6.3.1A Service-level authentication and authorization procedure

6.3.1A.1 General

The purpose of the service-level authentication and authorization (service-level-AA) procedure is to enable the DN using NEF services for authentication:

a) to authenticate the upper layers of the UE, when establishing the PDU session;

b) to authorize the upper layers of the UE, when establishing the PDU session;

c) both of the above; or

d) to re-authenticate the upper layers of the UE after establishment of the PDU session.

The service-level authentication and authorization procedure is used for UUAA as specified in 3GPP TS 23.256 [6AB].

NOTE 1: The authentication protocol for UUAA is out of scope of 3GPP in this release of specification.

The service-level authentication and authorization procedure can be performed only during or after the UE-requested PDU session procedure establishing a non-emergency PDU session. The service-level authentication and authorization procedure shall not be performed during or after the UE-requested PDU session establishment procedure establishing an emergency PDU session.

If the service-level authentication and authorization procedure is performed during the UE-requested PDU session establishment procedure:

a) and the service-level-AA procedure of the UE completes successfully, the service-level-AA response is transported from the network to the UE as a part of the UE-requested PDU session establishment procedure in the PDU SESSION ESTABLISHMENT ACCEPT message; or

b) and the service-level-AA procedure of the UE completes unsuccessfully, the service-level-AA response is transported from the network to the UE as a part of the UE-requested PDU session establishment procedure in the PDU SESSION ESTABLISHMENT REJECT message.

NOTE 2: If the SMF receives the HTTP code set to "4xx" or "5xx" as specified in 3GPP TS 29.500 [20AA] or the SMF detects a UUAA-SM failure as specified in 3GPP TS 29.256 [21B], then the SMF considers that the UUAA-SM procedure has completed unsuccessfully.

If the service-level authentication and authorization procedure is performed for the established PDU session with re-authentication purpose:

a) and the service-level-AA procedure of the UE completes successfully, the service-level-AA response is transported from the network to the UE as a part of the network-requested PDU session modification procedure in the PDU SESSION MODIFICATION COMMAND message; or

b) and the service-level-AA procedure of the UE completes unsuccessfully, the service-level-AA response is transported from the network to the UE as a part of the network-requested PDU session release procedure in the PDU SESSION RELEASE COMMAND message.

There can be several rounds of exchange of a service-level-AA payload for the service to complete the service-level authentication and authorization of the request for a PDU session (see example in figure 6.3.1A.1-1).

If the UE receives the service-level-AA response in the PDU SESSION ESTABLISHMENT ACCEPT message or the PDU SESSION ESTABLISHMENT REJECT message, the UE passes it to the upper layer.

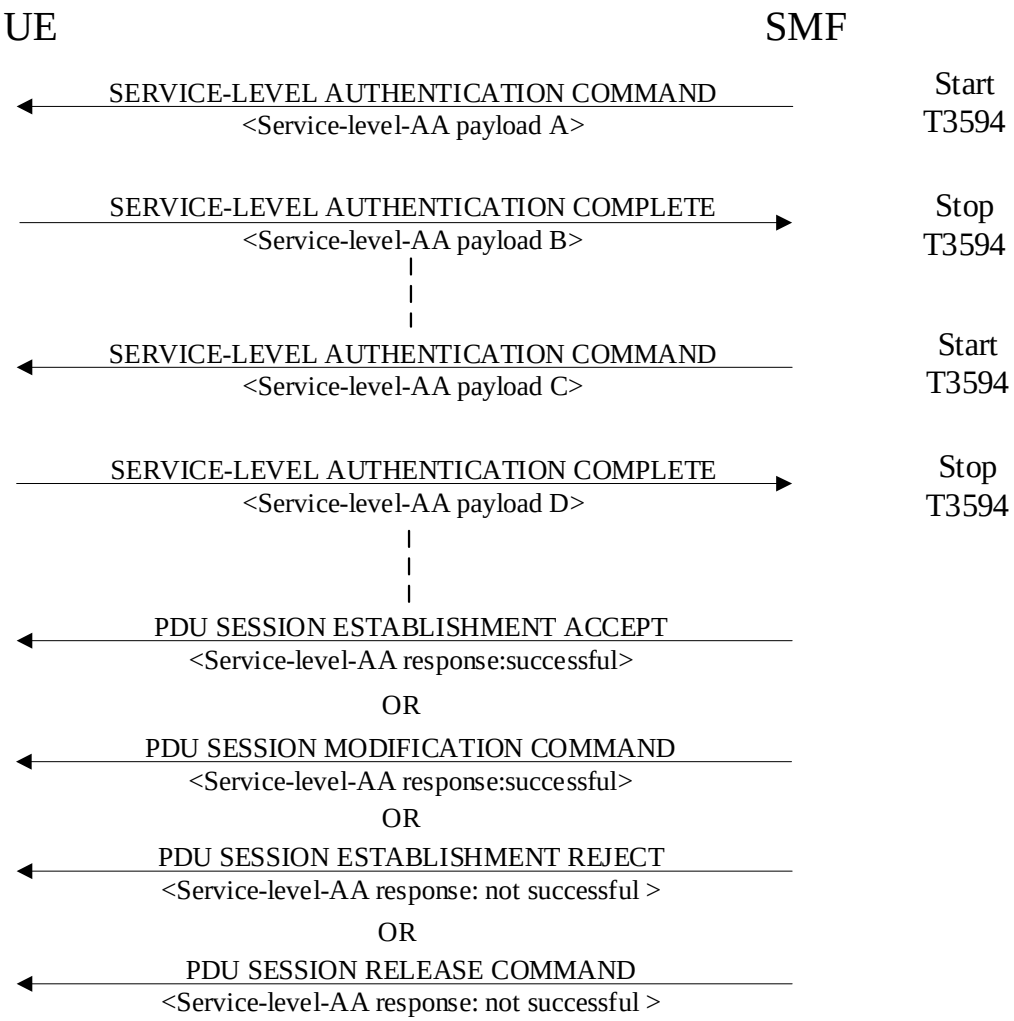


Figure 6.3.1A.1-1: Service-level authentication and authorization procedure

6.3.1A.2 Service-level authentication and authorization procedure initiation

In order to initiate the service-level authentication and authorization procedure, the SMF shall create a SERVICE-LEVEL AUTHENTICATION COMMAND message.

The SMF shall set the PTI IE of the SERVICE-LEVEL AUTHENTICATION COMMAND message to "No procedure transaction identity assigned".

The SMF shall set the service-level-AA payload in the Service-level-AA container IE of the SERVICE-LEVEL AUTHENTICATION COMMAND message to the payload provided by the DN via the NEF. If a payload type associated with the payload is provided by the DN via the NEF, the SMF shall set the service-level-AA payload type with the value set to the payload type.

NOTE 1: In case of UUAA, the service-level-AA payload is provided by the DN via the UAS-NF.

The SMF shall send the SERVICE-LEVEL AUTHENTICATION COMMAND message, and the SMF shall start timer T3594 (see example in figure 6.3.1A.1-1).

Upon receipt of the SERVICE-LEVEL AUTHENTICATION COMMAND message, if the UE provided a DNN during the PDU session establishment, the UE shall stop timer T3396, if it is running for the DNN provided by the UE. If the UE did not provide a DNN during the PDU session establishment, the UE shall stop the timer T3396 associated with no DNN if it is running. In an SNPN, the timer T3396 to be stopped includes:

a) the timer T3396 applied for all the equivalent SNPNs, associated with the RSNPN or an equivalent SNPN, and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

b) the timer T3396 applied for the registered SNPN, associated with the RSNPN, and, if the UE supports access to an SNPN using credentials from a credentials holder, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

Upon receipt of the SERVICE-LEVEL AUTHENTICATION COMMAND message, if the UE provided an S-NSSAI and a DNN during the PDU session establishment, the UE shall stop timer T3584, if it is running for the [S-NSSAI of the PDU session, DNN] combination. If the UE provided a DNN but did not provide an S-NSSAI during the PDU session establishment, the UE shall stop timer T3584, if it is running for the same [no S-NSSAI, DNN] combination provided by the UE. If the UE provided an S-NSSAI but did not provide a DNN during the PDU session establishment, the UE shall stop timer T3584, if it is running for the same [S-NSSAI, no DNN] combination provided by the UE. If the UE provided neither a DNN nor an S-NSSAI during the PDU session establishment, the UE shall stop timer T3584, if it is running for the same [no S-NSSAI, no DNN] combination provided by the UE. The timer T3584 to be stopped includes:

a) in a PLMN:

1) the timer T3584 applied for all the PLMNs, if running, and

2) the timer T3584 applied for the registered PLMN, if running; or

b) in an SNPN:

1) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

2) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

Upon receipt of the SERVICE-LEVEL AUTHENTICATION COMMAND message, if the UE provided an S-NSSAI during the PDU session establishment, the UE shall stop timer T3585, if it is running for the S-NSSAI of the PDU session. If the UE did not provide an S-NSSAI during the PDU session establishment, the UE shall stop the timer T3585 associated with no S-NSSAI if it is running. The timer T3585 to be stopped includes:

a) in a PLMN:

- the timer T3585 applied for all the PLMNs and for the access over which the SERVICE-LEVEL AUTHENTICATION COMMAND message is received, if running;

- the timer T3585 applied for all the PLMNs and for both 3GPP access type and non-3GPP access type, if running;

- the timer T3585 applied for the registered PLMN and for the access over which the SERVICE-LEVEL AUTHENTICATION COMMAND message is received, if running; and

- the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, if running; or

b) in an SNPN:

1) the timer T3585 applied for all the equivalent SNPNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

2) the timer T3585 applied for all the equivalent SNPNs and for both 3GPP access type and non-3GPP access type, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

3) the timer T3585 applied for the registered SNPN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

4) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials

holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

NOTE 2: Upon receipt of the SERVICE-LEVEL AUTHENTICATION COMMAND message for a PDU session, if the UE provided a DNN (or no DNN) and an S-NSSAI (or no S-NSSAI) when the PDU session is established, timer T3396 associated with the DNN (or no DNN, if no DNN was provided by the UE) is running, and timer T3584 associated with the DNN (or no DNN, if no DNN was provided by the UE) and the S-NSSAI (or no S-NSSAI, if no S-NSSAI was provided by the UE) is running, then the UE stops both the timer T3396 and the timer T3584.

NOTE 3: Upon receipt of the SERVICE-LEVEL AUTHENTICATION COMMAND message for a PDU session, if the UE provided a DNN (or no DNN) and an S-NSSAI (or no S-NSSAI) when the PDU session is established, timer T3585 associated with the S-NSSAI (or no S-NSSAI, if no S-NSSAI was provided by the UE) is running, and timer T3584 associated with the DNN (or no DNN, if no DNN was provided by the UE) and the S-NSSAI (or no S-NSSAI, if no S-NSSAI was provided by the UE) is running, then the UE stops both the timer T3585 and the timer T3584.

Upon receipt of a SERVICE-LEVEL AUTHENTICATION COMMAND message and a PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5, the UE passes to the upper layers the service-level-AA payload received in the Service-level-AA container IE of the SERVICE-LEVEL AUTHENTICATION COMMAND message. Apart from this action, the service-level authentication and authorization procedure initiated by the DN is transparent to the 5GSM layer of the UE.

6.3.1A.3 Service-level authentication and authorization procedure accepted by the UE

When the upper layers provide a service-level-AA payload, the UE shall create a SERVICE-LEVEL AUTHENTICATION COMPLETE message and set the service-level-AA payload of the Service-level-AA container IE to the service-level-AA payload received from the upper layers, and if the service-level-AA payload type is received in the SERVICE-LEVEL AUTHENTICATION COMMAND message from the SMF, set the service-level-AA payload type of the Service-level-AA container IE to the service-level-AA payload type received from the SMF.

The UE shall transport the SERVICE-LEVEL AUTHENTICATION COMPLETE message and the PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5. Apart from this action, the service-level authentication and authorization procedure initiated by the DN is transparent to the 5GSM layer of the UE.

Upon receipt of a SERVICE-LEVEL AUTHENTICATION COMPLETE message, the SMF shall stop timer T3594 and provides the service-level-AA payload received in the Service-level-AA container IE of the SERVICE-LEVEL AUTHENTICATION COMPLETE message to the DN.

6.3.1A.4 Abnormal cases on the network side

The following abnormal cases can be identified:

a) Expiry of timer T3594.

   On the first expiry of the timer T3594, the SMF shall resend the SERVICE-LEVEL AUTHENTICATION COMMAND message and shall reset and restart timer T3594. This retransmission is repeated four times, i.e., on the fifth expiry of timer T3594, the SMF shall abort the procedure and send PDU SESSION ESTABLISHMENT REJECT message with the 5GSM cause #29 "user authentication or authorization failed" as specified in subclause 6.4.1.4.1.

6.3.1A.5 Abnormal cases in the UE

The following abnormal case can be identified:

a) Collision of UE-requested PDU session release procedure and a service-level authentication and authorization procedure.

   When the UE receives a SERVICE-LEVEL AUTHENTICATION COMMAND message during the UE-requested PDU session release procedure, and the PDU session indicated in SERVICE-LEVEL AUTHENTICATION COMMAND message is the PDU session that the UE has requested to release, the UE shall ignore the SERVICE-LEVEL AUTHENTICATION COMMAND message and proceed with the UE-requested PDU session release procedure.

6.3.2 Network-requested PDU session modification procedure

6.3.2.1 General

The purpose of the network-requested PDU session modification procedure is to enable the network to modify a PDU session, re-negotiate header compression configuration associated to a PDU session, convey a port management information container, to trigger EAS rediscovery, provide updated DNS server address(es) due to the newly selected local DNS server or the newly selected EASDF, provide updated ECS configuration information, remove joined UE from one or more multicast MBS sessions associated with a PDU session, update ATSSS parameters (e.g. ATSSS rules), update the MBS service area or the security information of multicast MBS session that the UE has joined or to inform about the result of service-level AA procedure or C2 authorization for UAS services.

6.3.2.2 Network-requested PDU session modification procedure initiation

In order to initiate the network-requested PDU session modification procedure, the SMF shall create a PDU SESSION MODIFICATION COMMAND message.

If the authorized QoS rules of the PDU session is modified or is marked as to be synchronised with the UE, the SMF shall set the Authorized QoS rules IE of the PDU SESSION MODIFICATION COMMAND message to the authorized QoS rules of the PDU session. The SMF shall ensure that the number of the packet filters used in the authorized QoS rules of the PDU Session does not exceed the maximum number of packet filters supported by the UE for the PDU session. The SMF may bind service data flows for which the UE has requested traffic segregation to a dedicated QoS flow for the PDU session, if possible. Otherwise the SMF may bind the service data flows to an existing QoS flow. The SMF shall use only one dedicated QoS flow for traffic segregation. If the UE has requested traffic segregation for multiple service data flows with different QoS handling, the SMF shall bind all these service data flows to a single QoS flow. If the SMF allows traffic segregation for service data flows in a QoS rule, then the SMF shall create a new authorized QoS rule for these service data flows and shall delete packet filters corresponding to these service data flows from the other authorized QoS rules.

If the authorized QoS flow descriptions of the PDU session is modified or is marked as to be synchronised with the UE, the SMF shall set the Authorized QoS flow descriptions IE of the PDU SESSION MODIFICATION COMMAND message to the authorized QoS flow descriptions of the PDU session.

If SMF creates a new authorized QoS rule for a new QoS flow, then SMF shall include the authorized QoS flow description for that QoS flow in the Authorized QoS flow descriptions IE of the PDU SESSION MODIFICATION COMMAND message, if:

a) the newly created authorized QoS rules is for a new GBR QoS flow;

b) the QFI of the new QoS flow is not the same as the 5QI of the QoS flow identified by the QFI;

c) the new QoS flow can be mapped to an EPS bearer as specified in subclause 4.11.1 of 3GPP TS 23.502 [9]; or

d) the new QoS flow is established for the PDU session used for relaying, as specified in subclause 5.6.2.1 of 3GPP TS 23.304 [6E].

NOTE 0: In cases other than above listed cases, it is up to the SMF implementation to include the authorized QoS flow description of the new QoS flow for the new authorized QoS rule in the Authorized QoS flow descriptions IE of the PDU SESSION MODIFICATION COMMAND message.

If the session-AMBR of the PDU session is modified, the SMF shall set the selected Session-AMBR IE of the PDU SESSION MODIFICATION COMMAND message to the session-AMBR of the PDU session.

If interworking with EPS is supported for the PDU session and if the mapped EPS bearer contexts of the PDU session is modified, the SMF shall set the Mapped EPS bearer contexts IE of the PDU SESSION MODIFICATION COMMAND message to the mapped EPS bearer contexts of the PDU session. If the association between a QoS flow and the mapped EPS bearer context is changed, the SMF shall set the EPS bearer identity parameter in Authorized QoS flow descriptions IE of the PDU SESSION MODIFICATION COMMAND message to the new EPS bearer identity associated with the QoS flow.

NOTE 0A: The SMF can include multiple mapped EPS bearer context fields with the same EPS bearer identity in the Mapped EPS bearer contexts IE of the PDU SESSION MODIFICATION COMMAND message in cases, e.g. the packet filters need to be modified and the modification requires more than one TFT operation codes or the mapped traffic flow template needs to be modified and the modification exceeds the maximum size of the TFT IE.

If the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure and the PDU SESSION MODIFICATION REQUEST message includes a 5GSM capability IE, the SMF shall:

a) if the RQoS bit is set to:

   1) "Reflective QoS supported", consider that the UE supports reflective QoS for this PDU session; or

   2) "Reflective QoS not supported", consider that the UE does not support reflective QoS for this PDU session; and;

b) if the MH6-PDU bit is set to:

   1) "Multi-homed IPv6 PDU session supported", consider that this PDU session is supported to use multiple IPv6 prefixes; or

   2) "Multi-homed IPv6 PDU session not supported", consider that this PDU session is not supported to use multiple IPv6 prefixes.

If the SMF considers that reflective QoS is supported for QoS flows belonging to this PDU session, the SMF may include the RQ timer IE set to an RQ timer value in the PDU SESSION MODIFICATION COMMAND message.

If a port management information container needs to be delivered (see 3GPP TS 23.501 [8] and 3GPP TS 23.502 [9]) and the UE has set the TPMIC bit to "Transfer of port management information containers supported" in the 5GSM capability IE, the SMF shall include a Port management information container IE in the PDU SESSION MODIFICATION COMMAND message.

For a PDN connection established when in S1 mode, upon an inter-system change from S1 mode to N1 mode, if the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure and a UE-requested PDU session modification procedure has not been successfully performed yet, the PDU session type is "IPv4", "IPv6", "IPv4v6" or "Ethernet" and the PDU SESSION MODIFICATION REQUEST message includes a Maximum number of supported packet filters IE, the SMF shall consider this number as the maximum number of packet filters that can be supported by the UE for this PDU session. Otherwise the SMF considers that the UE supports 16 packet filters for this PDU session.

For a PDN connection established when in S1 mode, upon an inter-system change from S1 mode to N1 mode, if the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure and a UE-requested PDU session modification procedure has not been successfully performed yet, the SMF shall consider that the maximum data rate per UE for user-plane integrity protection supported by the UE for uplink and the maximum data rate per UE for user-plane integrity protection supported by the UE for downlink are valid for the lifetime of the PDU session.

For a PDN connection established when in S1 mode, upon an inter-system change from S1 mode to N1 mode, if the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure and a UE-requested PDU session modification procedure has not been successfully performed yet, and the SMF determines, based on local policies or configurations in the SMF and the Always-on PDU session requested IE in the PDU SESSION MODIFICATION REQUEST message (if available), that either:

a) the requested PDU session needs to be an always-on PDU session, the SMF shall include the Always-on PDU session indication IE in the PDU SESSION MODIFICATION COMMAND message and shall set the value to "Always-on PDU session required"; or

b) the requested PDU session shall not be an always-on PDU session and:

   1) if the UE included the Always-on PDU session requested IE, the SMF shall include the Always-on PDU session indication IE in the PDU SESSION MODIFICATION COMMAND message and shall set the value to "Always-on PDU session not allowed"; or

2) if the UE did not include the Always-on PDU session requested IE, the SMF shall not include the Always-on PDU session indication IE in the PDU SESSION MODIFICATION COMMAND message.

For a PDN connection established when in S1 mode, upon an inter-system change from S1 mode to N1 mode, if the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure, a UE-requested PDU session modification procedure has not been successfully performed yet, the UE supports EDC and the network allows the use of EDC, then the SMF shall include the Extended protocol configuration options IE in the PDU SESSION MODIFICATION COMMAND message with the EDC usage allowed indicator.

For a PDN connection established when in S1 mode, upon an inter-system change from S1 mode to N1 mode, if the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure, a UE-requested PDU session modification procedure has not been successfully performed yet, the UE supports EDC and the network requires the use of EDC, then the SMF shall include the Extended protocol configuration options IE in the PDU SESSION MODIFICATION COMMAND message with the EDC usage required indicator.

If a QoS flow for URLLC is created in a PDU session and the SMF has not provided the Always-on PDU session indication IE with the value set to "Always-on PDU session required" in the UE-requested PDU session establishment procedure or a network-requested PDU session modification procedure for the PDU session, the SMF shall include the Always-on PDU session indication IE in the PDU SESSION MODIFICATION COMMAND message and shall set the value to "Always-on PDU session required".

For a PDN connection, upon an inter-system change from S1 mode to N1 mode, if the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure and a UE-requested PDU session modification procedure has not been successfully performed yet, the PDU session is a single access PDU session over 3GPP access with IP PDU session type, the SMF may decide to provide the protocol description associated with the PDU session and may include the Protocol description IE in the PDU SESSION MODIFICATION COMMAND message.

If the value of the RQ timer is set to "deactivated" or has a value of zero, the UE considers that RQoS is not applied for this PDU session and remove the derived QoS rule(s) associated with the PDU session, if any.

If the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure, the SMF shall set the PTI IE of the PDU SESSION MODIFICATION COMMAND message to the PTI of the PDU SESSION MODIFICATION REQUEST message received as part of the UE-requested PDU session modification procedure.

If the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure and the UE has included the Requested MBS container IE in the PDU SESSION MODIFICATION REQUEST message with the MBS operation set to "Join multicast MBS session", the SMF:

a) shall include the TMGI for the multicast MBS session IDs that the UE is allowed to join, if any, in the Received MBS container IE, shall set the MBS decision to "MBS join is accepted" for each of those Received MBS information, may include the MBS start time to indicate the time when the multicast MBS session starts, and shall include the MBS security container in each of those Received MBS information if security protection is applied for that multicast MBS session and the control plane security procedure is used as specified in annex W.4.1.2 in 3GPP TS 33.501 [24], and shall use separate QoS flows dedicated for multicast by including the Authorized QoS flow descriptions IE if no separate QoS flows dedicated for multicast exist or if the SMF wants to establish new QoS flows dedicated for multicast;

NOTE 1: The network determines whether security protection applies or not for the multicast MBS session as specified in 3GPP TS 33.501 [24].

b) shall include the TMGI for multicast MBS session IDs that the UE is rejected to join, if any, in the Received MBS container IE, shall set the MBS decision to "MBS join is rejected" for each of those Received MBS information, shall set the Rejection cause for each of those Received MBS information with the reason of rejection and, if the Rejection cause is set to "multicast MBS session has not started or will not start soon", may include an MBS back-off timer value; and

c) may include in the Received MBS container IE the MBS service area for each multicast MBS session and include in it the MBS TAI list, the NR CGI list or both, that identify the service area(s) for the local MBS service;

NOTE 2: For an multicast MBS session that has multiple MBS service areas, the MBS service areas are indicated to the UE using MBS service announcement as described in 3GPP TS 23.247 [53], which is out of scope of this specification.

in the PDU SESSION MODIFICATION COMMAND message. If the UE has set the Type of multicast MBS session ID to "Source specific IP multicast address" in the Requested MBS container IE for certain multicast MBS session(s) in the PDU SESSION MODIFICATION REQUEST message, the SMF shall include the Source IP address information and Destination IP address information in the Received MBS information together with the TMGI for each of those multicast MBS sessions.

NOTE 3: Including the Source IP address information and Destination IP address information in the Received MBS information in that case is to allow the UE to perform the mapping between the requested multicast MBS session ID and the provided TMGI.

NOTE 4: In SNPN, TMGI is used together with NID to identify an MBS Session.

If:

a) the SMF wants to remove joined UE from one or more multicast MBS sessions; or

b) the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure and the UE has included the Requested MBS container IE in the PDU SESSION MODIFICATION REQUEST message with the MBS operation set to "Leave multicast MBS session",

the SMF shall include the multicast MBS session IDs that the UE is removed from, if any, in the Received MBS container IE in the PDU SESSION MODIFICATION COMMAND message and shall set the MBS decision to "Remove UE from multicast MBS session" for each of those Received MBS information. The SMF may include the updated MBS service area in each of the Received MBS information, if any. The SMF may delete the QoS flows associated for the multicast by including the Authorized QoS flow descriptions IE in the PDU SESSION MODIFICATION COMMAND message. If the UE is removed from multicast MBS session due to the MBS session release, the SMF shall set the Rejection cause to "multicast MBS session is released". The SMF shall include the Rejection cause for each of the Received MBS information, if any, and set its value with the reason of removing the UE from the corresponding multicast MBS session.

NOTE 5: based on operator's policy, e.g. after a locally configured time period, the SMF is allowed to trigger the removal of joined UE from an multicast MBS session when the UE moves outside all the MBS service area(s) of that multicast MBS session.

If the SMF wants to update the MBS security information of an multicast MBS session that the UE has joined, the SMF shall include the corresponding multicast MBS session ID and the MBS security container in the Received MBS container IE in the PDU SESSION MODIFICATION COMMAND message, and shall set the MBS Decision to "MBS security information update" in the Received MBS information.

If the SMF wants to update the MBS service area of an multicast MBS session that the UE has joined, the SMF shall include the corresponding multicast MBS session ID and the updated MBS service area in the Received MBS container IE in the PDU SESSION MODIFICATION COMMAND message, and shall set the MBS decision to "MBS service area update" in the Received MBS information.

NOTE 6: The MBS service area of an multicast MBS session is also allowed to be updated to the UE using the MBS service announcement as described in 3GPP TS 23.247 [53], which is out of scope of this specification.

If the network needs to update ATSSS parameters (see subclause 5.2.4 of 3GPP TS 24.193 [13B]), the SMF shall include the ATSSS container IE with the updates of ATSSS parameters in the PDU SESSION MODIFICATION COMMAND message.

If the network-requested PDU session modification procedure is not triggered by a UE-requested PDU session modification procedure, the SMF shall set the PTI IE of the PDU SESSION MODIFICATION COMMAND message to "No procedure transaction identity assigned".

If the selected SSC mode of the PDU session is "SSC mode 3" and the SMF requests the relocation of SSC mode 3 PDU session anchor with multiple PDU sessions as specified in 3GPP TS 23.502 [9], the SMF shall include 5GSM cause #39 "reactivation requested", in the PDU SESSION MODIFICATION COMMAND message, and may include the PDU session address lifetime in a PDU session address lifetime parameter in the Extended protocol configuration options IE of the PDU SESSION MODIFICATION COMMAND message. If the selected SSC mode of the PDU

session is "SSC mode 3", the S-NSSAI or the mapped S-NSSAI associated with the PDU session needs to be replaced and the SMF determines that the PDU session needs to be re-established on the alternative S-NSSAI, the SMF shall include the Alternative S-NSSAI IE and 5GSM cause #39 "reactivation requested" in the PDU SESSION MODIFICATION COMMAND message. If the selected SSC mode of the PDU session is "SSC mode 3", the replaced S-NSSAI is available and the SMF determines that the PDU session needs to be re-established on the replaced S-NSSAI, the SMF shall include and 5GSM cause #39 "reactivation requested" and include the replaced S-NSSAI in the PDU SESSION MODIFICATION COMMAND message.

NOTE 7: The relocation of SSC mode 3 PDU session anchor with multiple PDU sessions can also be initiated by the SMF in case of the SMF is requested by the AMF to release the PDU session due to the network slice instance of the PDU session is changed as specified in subclause 5.15.5.3 of 3GPP TS 23.501 [8].

The SMF shall send the PDU SESSION MODIFICATION COMMAND message, and the SMF shall start timer T3591 (see example in figure 6.3.2.2.1).

NOTE 8: If the SMF requests the relocation of SSC mode 3 PDU session anchor with multiple PDU sessions as specified in 3GPP TS 23.502 [9], the reallocation requested indication indicating whether the SMF is to be reallocated or the SMF is to be reused is provided to the AMF.

If the control plane CIoT 5GS optimization is enabled for a PDU session and the IP header compression configuration IE was included in the PDU SESSION ESTABLISHMENT REQUEST message or the PDU SESSION MODIFICATION REQUEST message, and the SMF supports control plane CIoT 5GS optimization and IP header compression for control plane CIoT 5GS optimization, the SMF may include the IP header compression configuration IE in the PDU SESSION MODIFICATION COMMAND message to re-negotiate IP header compression configuration associated to the PDU session.

If the control plane CIoT 5GS optimization is enabled for a PDU session and the Ethernet header compression configuration IE was included in the PDU SESSION ESTABLISHMENT REQUEST message or the PDU SESSION MODIFICATION REQUEST message, and the SMF supports control plane CIoT 5GS optimization and Ethernet header compression for control plane CIoT 5GS optimization, the SMF may include the Ethernet header compression configuration IE in the PDU SESSION MODIFICATION COMMAND message to re-configure Ethernet header compression configuration associated with the PDU session.

If the network-requested PDU session modification procedure is associated with C2 authorization procedure, the SMF shall send the PDU SESSION MODIFICATION COMMAND message by including the Service-level-AA container IE containing:

a) the service-level-AA response with the value of C2AR field set to the "C2 authorization was successful";

b) if a payload is provided from the UAS-NF, the service-level-AA payload with the value set to the payload; and

c) if a payload type associated with the payload is provided from the UAS-NF, the service-level-AA payload type with the value set to the payload type; and

d) if the CAA-level UAV ID is provided from the UAS-NF, the service-level device ID set to the CAA-level UAV ID.

NOTE 9: The C2 authorization payload in the service-level-AA payload can include one, some or all of the pairing information for C2 communication, and the pairing information for direct C2 communication,

NOTE 9A: The C2 authorization payload in the service-level-AA payload can include the security information for C2 session as specified in TS 33.256 [24B].

If the service-level-AA procedure is triggered for the established PDU session for UAS services with re-authentication purpose, and the SMF is provided by the UAS-NF with the successful UUAA-SM result, the SMF shall transmit a PDU SESSION MODIFICATION COMMAND message to the UE, where the PDU SESSION MODIFICATION COMMAND message shall include the Service-level-AA container IE containing:

a) the service-level-AA response with the value of SLAR field set to "Service level authentication and authorization was successful";

b) if received the CAA-level UAV ID from the UAS-NF, the service-level device ID with the value set to the CAA-level UAV ID;

c) if received a payload from the UAS-NF, the service-level-AA payload with the value set to the payload; and

d) if received a payload type associated with the payload, the service-level-AA payload type with the value set to the payload type.

If the SMF needs to provide new ECS configuration information to the UE and the UE has indicated support for ECS configuration information provisioning in the PDU SESSION ESTABLISHMENT REQUEST message or while in S1 mode, then the SMF may include the Extended protocol configuration options IE in the PDU SESSION MODIFICATION COMMAND message with:

a) at least one of ECS IPv4 Address(es), ECS IPv6 Address(es), ECS FQDN(s);

b) at least one associated ECSP identifier;

c) optionally, spatial validity conditions associated with the ECS address;

d) optionally, ECS authentication methods associated with the ECS address; and

e) optionally, ECS supported PLMNs information list, including the associated ECSP information for which the EDN configuration information can be provided by the ECS.

NOTE 10: The IP address(es), FQDN(s), or both are associated with the ECSP identifier and replace previously provided ECS configuration information associated with the same ECSP identifier, if any.

If the SMF needs to provide DNS server address(es) to the UE and the UE has provided the DNS server IPv4 address request, the DNS server IPv6 address request or both of them, in the PDU SESSION ESTABLISHMENT REQUEST message or a PDU SESSION MODIFICATION REQUEST message, then the SMF shall include the Extended protocol configuration options IE in the PDU SESSION MODIFICATION COMMAND message with one or more DNS server IPv4 address(es), one or more DNS server IPv6 address(es) or both of them.

If the SMF needs to trigger EAS rediscovery and the UE has indicated support of the EAS rediscovery in the PDU SESSION ESTABLISHMENT REQUEST message or the PDU SESSION MODIFICATION REQUEST message, then the SMF shall include the Extended protocol configuration options IE in the PDU SESSION MODIFICATION COMMAND message:

a) with the EAS rediscovery indication without indicated impact; or

b) with the following:

1) one or more EAS rediscovery indication(s) with impacted EAS IPv4 address range, if the UE supports EAS rediscovery indication(s) with impacted EAS IPv4 address range;

2) one or more EAS rediscovery indication(s) with impacted EAS IPv6 address range, if the UE supports EAS rediscovery indication(s) with impacted EAS IPv6 address range;

3) one or more EAS rediscovery indication(s) with impacted EAS FQDN, if the UE supports EAS rediscovery indication(s) with impacted EAS FQDN; or

4) any combination of the above.

When UE has requested P-CSCF IPv6 address or P-CSCF IPv4 address and the SMF has provided P-CSCF address(es) during the PDU session establishment procedure, if the network-requested PDU session modification procedure is triggered for P-CSCF restoration, the SMF shall include the P-CSCF IP address(es) in the Extended protocol configuration options IE in the PDU SESSION MODIFICATION COMMAND message as specified in subclause 5.8.2.2 of 3GPP TS 23.380 [54].

If the S-NSSAI or the mapped S-NSSAI of the PDU session needs to be replaced and the SMF determines that the PDU session needs to be retained, the SMF shall include the Alternative S-NSSAI IE in the PDU SESSION MODIFICATION COMMAND message. If the replaced S-NSSAI is available and the SMF determines that the PDU session needs to be retained, the SMF include replaced S-NSSAI in the PDU SESSION MODIFICATION COMMAND message.

If the SMF includes the authorized QoS flow descriptions and the SMF determines to provide the N3QAI to the UE, the SMF shall include the N3QAI IE in the PDU SESSION MODIFICATION COMMAND message.

If the PDU session was a single access PDU session established over 3GPP access with IP PDU session type and based on operator policy the SMF determines to provide the protocol description for UL PDU set handling to the UE, the SMF may include the Protocol description IE in the PDU SESSION MODIFICATION COMMAND message.

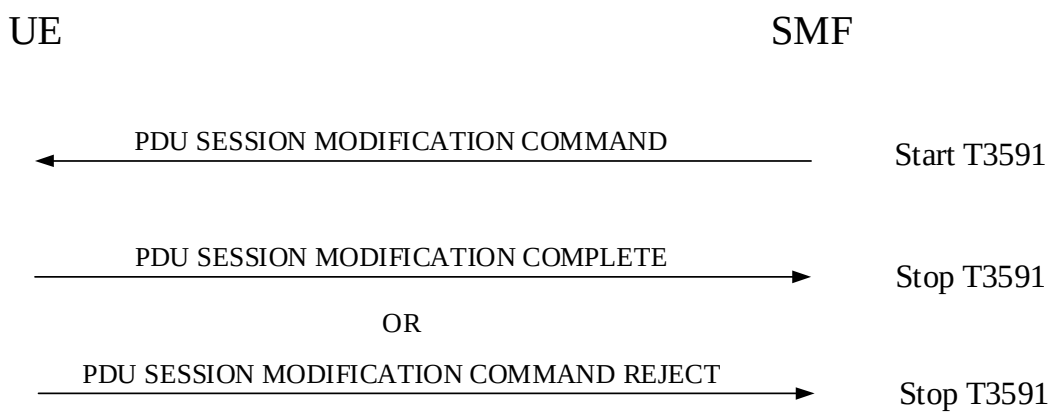


Figure 6.3.2.2.1: Network-requested PDU session modification procedure

6.3.2.3 Network-requested PDU session modification procedure accepted by the UE

Upon receipt of the PDU SESSION MODIFICATION COMMAND message, if the UE provided a DNN during the PDU session establishment, the UE shall stop timer T3396, if it is running for the DNN provided by the UE. If the UE did not provide a DNN 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 the timer T3396 associated with no DNN if it is running. If the PDU SESSION MODIFICATION COMMAND message was received for an emergency PDU session, the UE shall not stop the timer T3396 associated with no DNN if it is running. In an SNPN, the timer T3396 to be stopped includes:

b) the timer T3396 applied for all the equivalent SNPNs, associated with the RSNPN or an equivalent SNPN, and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

a) the timer T3396 applied for the registered SNPN, associated with the RSNPN, and, if the UE supports access to an SNPN using credentials from a credentials holder, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

Upon receipt of the PDU SESSION MODIFICATION COMMAND message, if the UE provided an S-NSSAI and a DNN during the PDU session establishment, the UE shall stop timer T3584, if it is running for the [S-NSSAI of the PDU session, DNN] combination provided by the UE. If the UE provided a DNN and did not provide an S-NSSAI during the PDU session establishment, the UE shall stop timer T3584, if it is running for the same [no S-NSSAI, DNN] combination provided by the UE. If the UE provided an S-NSSAI and did not provide a DNN during the PDU session establishment, the UE shall stop timer T3584, if it is running for the same [S-NSSAI, no DNN] combination provided by the UE. If the UE provided neither a DNN nor an S-NSSAI during the PDU session establishment, the UE shall stop timer T3584, if it is running for the same [no S-NSSAI, no DNN] combination provided by the UE. The timer T3584 to be stopped includes:

a) in a PLMN:

   1) the timer T3584 applied for all the PLMNs, if running; and

   2) the timer T3584 applied for the registered PLMN, if running; or

b) in an SNPN:

   1) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

   2) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

Upon receipt of the PDU SESSION MODIFICATION COMMAND message, if the UE provided an S-NSSAI during the PDU session establishment, the UE shall stop timer T3585, if it is running for the S-NSSAI of the PDU session. If the UE did not provide an S-NSSAI 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 the timer T3585 associated with no S-NSSAI if it is running. The timer T3585 to be stopped includes:

a) in a PLMN:

1) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION MODIFICATION COMMAND is received, if running;

2) the timer T3585 applied for all the PLMNs and for both 3GPP access type and non-3GPP access type, if running;

3) the timer T3585 applied for the registered PLMN and for the access over which the PDU SESSION MODIFICATION COMMAND is received, if running; and

4) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, if running; or

b) in an SNPN:

1) the timer T3585 applied for all the equivalent SNPNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

2) the timer T3585 applied for all the equivalent SNPNs and for both 3GPP access type and non-3GPP access type, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

3) the timer T3585 applied for the registered SNPN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

4) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

If the PDU SESSION MODIFICATION COMMAND message was received for an emergency PDU session, the UE shall not stop the timer T3585 associated with no S-NSSAI if it is running.

NOTE 1: Upon receipt of the PDU SESSION MODIFICATION COMMAND message for a PDU session, if the UE provided a DNN (or no DNN) and an S-NSSAI (or no S-NSSAI) when the PDU session is established, timer T3396 associated with the DNN (or no DNN, if no DNN was provided by the UE) is running, and timer T3584 associated with the DNN (or no DNN, if no DNN was provided by the UE) and the S-NSSAI of the PDU session (or no S-NSSAI, if no S-NSSAI was provided by the UE) is running, then the UE stops both the timer T3396 and the timer T3584.

NOTE 2: Upon receipt of the PDU SESSION MODIFICATION COMMAND message for a PDU session, if the UE provided a DNN (or no DNN) and an S-NSSAI (or no S-NSSAI) when the PDU session is established, timer T3585 associated with the S-NSSAI of the PDU session (or no S-NSSAI, if no S-NSSAI was provided by the UE) is running, and timer T3584 associated with the DNN (or no DNN, if no DNN was provided by the UE) and the S-NSSAI of the PDU session (or no S-NSSAI, if no S-NSSAI was provided by the UE) is running, then the UE stops both the timer T3585 and the timer T3584.

If the PDU SESSION MODIFICATION COMMAND message includes the Authorized QoS rules IE, the UE shall process the QoS rules sequentially starting with the first QoS rule.

If the PDU SESSION MODIFICATION COMMAND message includes the Authorized QoS rules IE with the Rule operation code is set to "Delete existing QoS rule" for one or more QoS rules, the UE shall delete the protocol descriptions associated with the QoS rules, if any.

If the PDU SESSION MODIFICATION COMMAND message includes the Mapped EPS bearer contexts IE, the UE shall process the mapped EPS bearer contexts sequentially starting with the first mapped EPS bearer context.

If the PDU SESSION MODIFICATION COMMAND message includes the Authorized QoS flow descriptions IE, the UE shall process the QoS flow descriptions sequentially starting with the first QoS flow description.

The UE shall replace the stored authorized QoS rules, authorized QoS flow descriptions and session-AMBR of the PDU session with the received value(s), if any, in the PDU SESSION MODIFICATION COMMAND message.

If the PDU SESSION MODIFICATION COMMAND message includes a Mapped EPS bearer contexts IE, the UE shall check each mapped EPS bearer context for different types of errors as follows:

NOTE 3: An error detected in a mapped EPS bearer context does not cause the UE to discard the Authorized QoS rules IE and Authorized QoS flow descriptions IE included in the PDU SESSION MODICATION COMMAND message, if any.

a) Semantic error in the mapped EPS bearer operation:

   1) operation code = "Create new EPS bearer" and there is already an existing mapped EPS bearer context with the same EPS bearer identity associated with any PDU session.

   2) operation code = "Delete existing EPS bearer" and there is no existing mapped EPS bearer context with the same EPS bearer identity associated with the PDU session that is being modified.

   3) operation code = "Modify existing EPS bearer" and there is no existing mapped EPS bearer context with the same EPS bearer identity associated with the PDU session that is being modified.

   4) operation code = "Create new EPS bearer" or "Modify existing EPS bearer" and the resulting mapped EPS bearer context has invalid mandatory parameters or missing mandatory parameters (e.g., mapped EPS QoS parameters or traffic flow template for a dedicated EPS bearer context).

   In case 1, if the existing mapped EPS bearer context is associated with the PDU session that is being modified, the UE shall not diagnose an error, further process the create request and, if it was process successfully, delete the old EPS bearer context.

   In case 2, the UE shall not diagnose an error, further process the delete request and, if it was processed successfully, consider the mapped EPS bearer context as successfully deleted.

   Otherwise, after sending the PDU SESSION MODIFICATION COMPLETE for the ongoing PDU session modification procedure, the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #85 "Invalid mapped EPS bearer identity".

b) if the mapped EPS bearer context includes a traffic flow template, the UE shall check the traffic flow template for different types of TFT IE errors as follows:

   1) Semantic errors in TFT operations:

      i) TFT operation = "Create new TFT" when there is already an existing TFT for the EPS bearer context.

      ii) When the TFT operation is an operation other than "Create a new TFT" and there is no TFT for the EPS bearer context.

      iii) TFT operation = "Delete packet filters from existing TFT" when it would render the TFT empty.

      iv) TFT operation = "Delete existing TFT" for a dedicated EPS bearer context.

      In case iv, after sending the PDU SESSION MODIFICATION COMPLETE for the ongoing PDU session modification procedure, the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #41 "semantic error in the TFT operation".

      In the other cases the UE shall not diagnose an error and perform the following actions to resolve the inconsistency:

In case i, the UE shall further process the new activation request to create a new TFT and, if it was processed successfully, delete the old TFT.

In case ii, the UE shall:

- process the new request and if the TFT operation is "Delete existing TFT" or "Delete packet filters from existing TFT", and if no error according to items 2, 3, and 4 was detected, consider the TFT as successfully deleted;

- process the new request as an activation request, if the TFT operation is "Add packet filters in existing TFT" or "Replace packet filters in existing TFT".

In case iii, if the packet filters belong to a dedicated EPS bearer context, the UE shall process the new deletion request and, if no error according to items 2, 3, and 4 was detected, after sending the PDU SESSION MODIFICATION COMPLETE for the ongoing PDU session modification procedure, the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #41 "semantic error in the TFT operation".

In case iii, if the packet filters belong to the default EPS bearer context, the UE shall process the new deletion request and if no error according to items 2, 3, and 4 was detected then delete the existing TFT, this corresponds to using match-all packet filter for the default EPS bearer context.

2) Syntactical errors in TFT operations:

   i) When the TFT operation = "Create new TFT", "Add packet filters in existing TFT", "Replace packet filters in existing TFT" or "Delete packet filters from existing TFT" and the packet filter list in the TFT IE is empty.

   ii) TFT operation = "Delete existing TFT" or "No TFT operation" with a non-empty packet filter list in the TFT IE.

   iii) TFT operation = "Replace packet filters in existing TFT" when the packet filter to be replaced does not exist in the original TFT.

   iv) TFT operation = "Delete packet filters from existing TFT" when the packet filter to be deleted does not exist in the original TFT.

   v) Void.

   vi) When there are other types of syntactical errors in the coding of the TFT IE, such as a mismatch between the number of packet filters subfield, and the number of packet filters in the packet filter list.

   In case iii, the UE shall not diagnose an error, further process the replace request and, if no error according to items 3 and 4 was detected, include the packet filters received to the existing TFT.

   In case iv, the UE shall not diagnose an error, further process the deletion request and, if no error according to items 3 and 4 was detected, consider the respective packet filter as successfully deleted.

   Otherwise, after sending the PDU SESSION MODIFICATION COMPLETE for the ongoing PDU session modification procedure, the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #42 "syntactical error in the TFT operation".

NOTE 3a: An implementation that strictly follows packet filter list as defined in subclause 10.5.6.12 in 3GPP TS 24.008 [12] might not detect case 2) ii).

3) Semantic errors in packet filters:

   i) When a packet filter consists of conflicting packet filter components which would render the packet filter ineffective, i.e. no IP packet will ever fit this packet filter. How the UE determines a semantic error in a packet filter is outside the scope of the present document.

   ii) When the resulting TFT, which is assigned to a dedicated EPS bearer context, does not contain any packet filter applicable for the uplink direction among the packet filters created on request from the network.

After sending the PDU SESSION MODIFICATION COMPLETE for the ongoing PDU session modification procedure, the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #44 "semantic errors in packet filter(s)".

4) Syntactical errors in packet filters:

i) When the TFT operation = "Create new TFT", "Add packet filters to existing TFT", or "Replace packet filters in existing TFT" and two or more packet filters in the resultant TFT would have identical packet filter identifiers.

ii) When the TFT operation = "Create new TFT", "Add packet filters to existing TFT" or "Replace packet filters in existing TFT", and two or more packet filters among all TFTs associated with this PDN connection would have identical packet filter precedence values.

iii) When there are other types of syntactical errors in the coding of packet filters, such as the use of a reserved value for a packet filter component identifier.

In case i, if two or more packet filters with identical packet filter identifiers are contained in the new request, after sending the PDU SESSION MODIFICATION COMPLETE for the ongoing PDU session modification procedure, the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #45 "syntactical error in packet filter(s)". Otherwise, the UE shall not diagnose an error, further process the new request and, if it was processed successfully, delete the old packet filters which have the identical packet filter identifiers.

In case ii, if the old packet filters do not belong to the default EPS bearer context, the UE shall not diagnose an error, shall further process the new request and, if it was processed successfully, shall delete the old packet filters which have identical filter precedence values.

In case ii, if one or more old packet filters belong to the default EPS bearer context, after sending the PDU SESSION MODIFICATION COMPLETE for the ongoing PDU session modification procedure, the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #45 "syntactical errors in packet filter(s)".

Otherwise, after sending the PDU SESSION MODIFICATION COMPLETE for the ongoing PDU session modification procedure, the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #45 "syntactical error in packet filter(s)".

And if a new EPS bearer identity parameter in Authorized QoS flow descriptions IE is received for a QoS flow which can be transferred to EPS, the UE shall update the association between the QoS flow and the mapped EPS bearer context, based on the new EPS bearer identity and the mapped EPS bearer contexts. If the "Delete existing EPS bearer" operation code in the Mapped EPS bearer contexts IE was received, the UE shall discard the association between the QoS flow and the corresponding mapped EPS bearer context and delete the corresponding mapped EPS bearer context.

If:

a) the UE detects different errors in the mapped EPS bearer contexts as described above which requires sending a PDU SESSION MODIFICATION REQUEST message to delete the erroneous mapped EPS bearer contexts; and

b) optionally, if the UE detects errors in QoS rules that require to delete at least one QoS rule as described in subclause 6.3.2.4 which requires sending a PDU SESSION MODIFICATION REQUEST message to delete the erroneous QoS rules;

the UE, after sending the PDU SESSION MODIFICATION COMPLETE message for the ongoing PDU session modification procedure, may send a single PDU SESSION MODIFICATION REQUEST message to delete the erroneous mapped EPS bearer contexts, and optionally to delete the erroneous QoS rules. The UE shall include a 5GSM cause IE in the PDU SESSION MODIFICATION REQUEST message.

NOTE 4: The 5GSM cause to use cannot be different from #41 "semantic error in the TFT operation", #42 "syntactical error in the TFT operation", #44 "semantic error in packet filter(s)", #45 "syntactical errors in packet filter(s)", #83 "semantic error in the QoS operation", #84 "syntactical error in the QoS operation", or #85 "Invalid mapped EPS bearer identity". The selection of a 5GSM cause is up to UE implementation.

Upon receipt of a PDU SESSION MODIFICATION COMMAND message and a PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5, if the UE accepts the PDU SESSION MODIFICATION COMMAND message, the UE considers the PDU session as modified and the UE shall create a PDU SESSION MODIFICATION COMPLETE message.

If the PDU SESSION MODIFICATION COMMAND message contains the PTI value allocated in the UE-requested PDU session modification procedure, the UE shall stop the timer T3581. The UE should ensure that the PTI value assigned to this procedure is not released immediately.

NOTE 5: The way to achieve this is implementation dependent. For example, the UE can ensure that the PTI value assigned to this procedure is not released during the time equal to or greater than the default value of timer T3591.

While the PTI value is not released, the UE regards any received PDU SESSION MODIFICATION COMMAND message with the same PTI value as a network retransmission (see subclause 7.3.1).

If the selected SSC mode of the PDU session is "SSC mode 3" and the PDU SESSION MODIFICATION COMMAND message includes 5GSM cause #39 "reactivation requested", the UE can provide to the upper layers the PDU session address lifetime if received in the PDU session address lifetime parameter of the Extended protocol configuration options IE of the PDU SESSION MODIFICATION COMMAND message. After the completion of the network-requested PDU session modification procedure:

a) if the PDU session is an MA PDU session:

   1) established over both 3GPP access and non-3GPP access, and:

      - the UE is registered over both 3GPP access and non-3GPP access in the same PLMN:

        - the UE should re-initiate a UE-requested PDU session establishment procedure as specified in subclause 6.4.1 over the access the PDU SESSION MODIFICATION COMMAND message is received; or

      - the UE is registered over both 3GPP access and non-3GPP access in different PLMNs:

        - the UE should re-initiate UE-requested PDU session establishment procedures as specified in subclause 6.4.1 over both accesses. The UE should re-initiate the UE-requested PDU session establishment procedure over the access the PDU SESSION MODIFICATION COMMAND message is received first; or

   2) established over only single access:

      - the UE should re-initiate a UE-requested PDU session establishment procedure as specified in subclause 6.4.1 over the access the user plane resources were established; or

b) if the PDU session is a single access PDU session:

   - the UE should re-initiate a UE-requested PDU session establishment procedure as specified in subclause 6.4.1 over the access the PDU session was associated with; and

for the re-initiated UE-requested PDU session establishment procedure(s) the UE should set a new PDU session ID different from the PDU session ID associated with the present PDU session and should set:

a) the PDU session type to the PDU session type associated with the present PDU session;

b) the SSC mode to the SSC mode associated with the present PDU session;

c) the DNN to the DNN associated with the present PDU session;

d) the S-NSSAI to:

   1) the S-NSSAI associated with (if available in roaming scenarios) a mapped S-NSSAI if provided in the UE-requested PDU session establishment procedure of the present PDU session; or

   2) the S-NSSAI received in the PDU SESSION ESTABLISHMENT ACCEPT message of the existing PDU session if the UE received the Alternative S-NSSAI IE in the PDU SESSION MODIFICATION COMMAND message; and

e) the alternative S-NSSAI to the S-NSSAI associated with (if available in roaming scenarios) a mapped S-NSSAI if received in the Alternative S-NSSAI IE of the PDU SESSION MODIFICATION COMMAND message.

If the UE has indicated support for CIoT 5GS optimizations and receives a small data rate control parameters container in the Extended protocol configuration options IE in the PDU SESSION MODIFICATION COMMAND message, the UE shall store the small data rate control parameters value and use the stored small data rate control parameters value as the maximum allowed limit of uplink user data for the PDU session in accordance with 3GPP TS 23.501 [8]. If the UE has a previously stored small data rate control parameter value for the PDU session, the UE shall replace the stored small data rate control parameters value for the PDU session with the received small data rate control parameters value in the Extended protocol configuration options IE in the PDU SESSION MODIFICATION COMMAND message.

If the UE has indicated support for CIoT 5GS optimizations and receives an additional small data rate control parameters for exception data container in the Extended protocol configuration options IE in the PDU SESSION MODIFICATION COMMAND message, the UE shall store the additional small data rate control parameters for exception data value and use the stored additional small data rate control parameters for exception data value as the maximum allowed limit of uplink exception data for the PDU session in accordance with 3GPP TS 23.501 [8]. If the UE has a previously stored additional small data rate control parameters for exception data value for the PDU session, the UE shall replace the stored additional small data rate control parameters for exception data value for the PDU session with the received additional small data rate control parameters for exception data value in the Extended protocol configuration options IE in the PDU SESSION MODIFICATION COMMAND message.

The UE shall include the PDU session ID of the old PDU session which is about to get released in the old PDU session ID IE of the UL NAS TRANSPORT message that transports the PDU SESSION ESTABLISHMENT REQUEST message.

NOTE 6: The UE is expected to maintain the PDU session for which the PDU SESSION MODIFICATION COMMAND message including 5GSM cause #39 "reactivation requested" is received during the time indicated by the PDU session address lifetime value or until receiving an indication from upper layers (e.g. that the old PDU session is no more needed).

If the selected PDU session type of the PDU session is "Unstructured", the UE supports inter-system change from N1 mode to S1 mode, the UE does not support establishment of a PDN connection for the PDN type set to "non-IP" in S1 mode, and the parameters list field of one or more authorized QoS flow descriptions received in the Authorized QoS flow descriptions IE of the PDU SESSION MODIFICATION COMMAND message contains an EPS bearer identity (EBI), then the UE shall locally remove the EPS bearer identity (EBI) from the parameters list field of such one or more authorized QoS flow descriptions. After sending the PDU SESSION MODIFICATION COMPLETE message for the ongoing PDU session modification procedure, the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #85 "Invalid mapped EPS bearer identity".

If the selected PDU session type of the PDU session is "Ethernet", the UE supports inter-system change from N1 mode to S1 mode, the UE does not support establishment of a PDN connection for the PDN type set to "non-IP" in S1 mode, the UE, the network or both of them do not support Ethernet PDN type in S1 mode, and the parameters list field of one or more authorized QoS flow descriptions received in the Authorized QoS flow descriptions IE of the PDU SESSION MODIFICATION COMMAND message contains an EPS bearer identity (EBI), the UE shall locally remove the EPS bearer identity (EBI) from the parameters list field of such one or more authorized QoS flow descriptions. After sending the PDU SESSION MODIFICATION COMPLETE message for the ongoing PDU session modification procedure, the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #85 "Invalid mapped EPS bearer identity".

For a UE which is registered for disaster roaming services and for a PDU session which is not a PDU session for emergency services:

a) if the parameters list field of one or more authorized QoS flow descriptions received in the Authorized QoS flow descriptions IE of the PDU SESSION MODIFICATION COMMAND message contains an EPS bearer identity (EBI), then the UE shall locally remove the EPS bearer identity (EBI) from the parameters list field of such one or more authorized QoS flow descriptions; and

b) the UE shall locally delete the contents of the Mapped EPS bearer contexts IE if it is received in the PDU SESSION MODIFICATION COMMAND message.

If the Always-on PDU session indication IE is included in the PDU SESSION MODIFICATION COMMAND message and:

a) the value of the IE is set to "Always-on PDU session required", the UE shall consider the established PDU session as an always-on PDU session; or

b) the value of the IE is set to "Always-on PDU session not allowed", the UE shall not consider the established PDU session as an always-on PDU session.

If the UE does not receive the Always-on PDU session indication IE in the PDU SESSION MODIFICATION COMMAND message:

a) if the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure upon an inter-system change from S1 mode to N1 mode for a PDN connection established when in S1 mode, the UE shall not consider the modified PDU session as an always-on PDU session; or

b) otherwise:

1) if the UE has received the Always-on PDU session indication IE with the value set to "Always-on PDU session required" for this PDU session, the UE shall consider the PDU session as an always-on PDU session; or

2) otherwise the UE shall not consider the PDU session as an always-on PDU session.

If the PDU SESSION MODIFICATION COMMAND message contains a Port management information container IE, the UE shall forward the contents of the Port management information container IE to the DS-TT (see 3GPP TS 23.501 [8] and 3GPP TS 23.502 [9]).

If the UE receives a Serving PLMN rate control IE in the PDU SESSION MODIFICATION COMMAND message, the UE shall store the Serving PLMN rate control IE value, replacing any existing value, and use the stored serving PLMN rate control value as the maximum allowed limit of uplink control plane user data for the corresponding PDU session in accordance with 3GPP TS 23.501 [8].

If the PDU SESSION MODIFICATION COMMAND message includes the Received MBS container IE, for each of the Received MBS informations:

a) if MBS decision is set to "MBS join is accepted", the UE shall consider that it has successfully joined the multicast MBS session. The UE shall store the received TMGI and shall use it for any further operation on that multicast MBS session. The UE shall store the received MBS service area associated with the received TMGI, if any, and provide the received TMGI to lower layers. The UE may provide the MBS start time if it is included in the Received MBS information to upper layers;

b) if MBS decision is set to "MBS join is rejected", the UE shall consider the requested join as rejected. The UE shall store the received MBS service area associated with the received TMGI, if any. If the received Rejection cause is set to "User is outside of local MBS service area", the UE shall not request to join the same multicast MBS session if neither current TAI nor CGI of the current cell is part of the received MBS service area. If the received Rejection cause is set to "multicast MBS session has not started or will not start soon" and an MBS back-off timer value is included with value that indicates neither zero nor deactivated, the UE shall start a back-off timer T3587 with the value provided in the MBS back-off timer value for the received TMGI, and shall not attempt to join the multicast MBS session with the same TMGI, the Source IP address information of the TMGI, or the Destination IP address information of the TMGI until the expiry of T3587. If the MBS back-off timer value indicates that this timer is deactivated, the UE shall not attempt to join the multicast MBS session with the same TMGI until the UE is switched off, the USIM is removed, or the entry in the "list of subscriber data" for the current SNPN is updated. If the MBS back-off timer value indicates zero, the UE may attempt to join the MBS session with the same TMGI;

c) if the MBS decision is set to "Remove UE from multicast MBS session", the UE shall consider that it has successfully left the multicast MBS session, and if the received Rejection cause is set to "multicast MBS session is released", the UE shall consider the multicast MBS session as released. Then the UE shall indicate to lower layers to delete the stored TMGI;

d) if the MBS decision is set to "MBS service area update", the UE shall store the received MBS service area associated with the received TMGI and replace the current MBS service area with the received one. or

e) if the MBS decision is set to "MBS security information update", the UE shall replace the current MBS security information with the MBS security information received in the MBS security container associated with the received TMGI.

If the UE has indicated support for ECS configuration information provisioning in the SESSION ESTABLISHMENT REQUEST message or while in S1 mode, then upon receiving

a) one or more ECS IPv4 address(es), ECS IPv6 address(es), ECS FQDN(s);

b) one or more associated ECSP identifier(s);

c) optionally spatial validity conditions associated with the ECS address;

d) optionally, ECS authentication methods associated with the ECS address; and

e) optionally, ECS supported PLMNs information list, including the associated ECSP information for which the EDN configuration information can be provided by the ECS.

in the Extended protocol configuration options IE of the PDU SESSION MODIFICATION COMMAND message, then the UE shall pass them to the upper layers.

If the UE supports receiving DNS server addresses in protocol configuration options and receives one or more DNS server IPv4 address(es), one or more DNS server IPv6 address(es) or both of them, in the Extended protocol configuration options IE of the PDU SESSION MODIFICATION COMMAND message, then the UE shall pass the received DNS server IPv4 address(es), if any, and the received DNS server IPv6 address(es), if any, to upper layers.

NOTE 7: The received DNS server address(es) replace previously provided DNS server address(es), if any.

If the UE supports the EAS rediscovery and receives:

a) the EAS rediscovery indication without indicated impact; or

b) the following:

1) one or more EAS rediscovery indication(s) with impacted EAS IPv4 address range, if supported by the UE;

2) one or more EAS rediscovery indication(s) with impacted EAS IPv6 address range, if supported by the UE;

3) one or more EAS rediscovery indication(s) with impacted EAS FQDN, if supported by the UE; or

4) any combination of the above;

in the Extended protocol configuration options IE of the PDU SESSION MODIFICATION COMMAND message, then the UE shall pass the EAS rediscovery indication and the received impacted EAS IPv4 address range(s), if supported and included, the received EAS IPv6 address range(s), if supported and included, and the received EAS FQDN(s), if supported and included, to upper layers.

NOTE 8: The upper layers handle the EAS rediscovery indication and the impacted EAS IPv4 address range(s), if any, the impacted EAS IPv6 address range(s), if any, and the received EAS FQDN(s), if any, according to 3GPP TS 23.548 [10A].

Upon receipt of PDU SESSION MODIFICATION COMMAND message, if the network-requested PDU session modification procedure is triggered by a UE-requested PDU session modification procedure, the Service-level-AA container IE is included, then the UE shall forward the service-level-AA contents of the Service-level-AA container IE to the upper layers.

If the UE supports EDC and receives the EDC usage allowed indicator in the Extended protocol configuration options IE of the PDU SESSION MODIFICATION COMMAND message, the UE shall indicate to upper layers that network allows the use of EDC.

If the UE supports EDC and receives the EDC usage required indicator in the Extended protocol configuration options IE of the PDU SESSION MODIFICATION COMMAND message, the UE shall indicate to upper layers that network requires the use of EDC.

NOTE 9: Handling of indication that network allows the use of EDC or that network requires the use of EDC is specified in 3GPP TS 23.548 [182].

If the Alternative S-NSSAI IE is included in the PDU SESSION MODIFICATION COMMAND message, the UE shall replace the S-NSSAI or the mapped S-NSSAI associated with the PDU session according to the Alternative S-NSSAI

IE. The S-NSSAI for the established PDU session shall be the S-NSSAI to be replaced and the alternative S-NSSAI on the UE side.

If the Protocol description IE is included in the PDU SESSION MODIFICATION COMMAND message, for each existing QoS rule,

a) for the protocol description field with the value of the length of protocol description field set to 1 for the associated QoS rule, the UE shall delete any previously stored protocol description for the QoS rule indicated by the QRI field of the protocol description field; and

b) for the protocol description field with the value of the length of protocol description field greater than 1 for the associated QoS rule, the UE shall, store the associated protocol description if there is no stored protocol description or replace any previously stored protocol description with the new received protocol description when there is stored protocol description for the QoS rule.

The UE may use the protocol description information associated with the QoS rule(s) provided by the Protocol description IE to identify PDUs belonging to PDU sets for the uplink direction.

NOTE 10: Whether and how to use the protocol description information to identify PDU sets is up to the UE implementation.

The UE shall transport the PDU SESSION MODIFICATION COMPLETE message and the PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5.

After sending the PDU SESSION MODIFICATION COMPLETE message, if the "Create new EPS bearer" operation code in the Mapped EPS bearer contexts IE was received in the PDU SESSION MODIFICATION COMMAND message and there is neither a corresponding Authorized QoS flow descriptions IE in the PDU SESSION MODIFICATION COMMAND message nor an existing QoS flow description corresponding to the EPS bearer identity included in the mapped EPS bearer context, the UE shall send a PDU SESSION MODIFICATION REQUEST message including a Mapped EPS bearer contexts IE to delete the mapped EPS bearer context.

After sending the PDU SESSION MODIFICATION COMPLETE message, if for the PDU session being modified, there are mapped EPS bearer context(s) but none of them is associated with the default QoS rule, the UE shall locally delete the mapped EPS bearer context(s) and shall locally delete the stored EPS bearer identity (EBI) in all the QoS flow descriptions of the PDU session, if any.

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 COMPLETE message.

Upon receipt of a PDU SESSION MODIFICATION COMPLETE message, the SMF shall stop timer T3591 and shall consider the PDU session as modified. If the selected SSC mode of the PDU session is "SSC mode 3" and the PDU SESSION MODIFICATION COMMAND message included 5GSM cause #39 "reactivation requested", the SMF shall start timer T3593. If the PDU Session Address Lifetime value is sent to the UE in the PDU SESSION MODIFICATION COMMAND message then timer T3593 shall be started with the same value, otherwise it shall use a default value. If the PDU SESSION MODIFICATION COMPLETE message contains a Port management information container IE, the SMF shall handle the contents of the Port management information container IE as specified in 3GPP TS 23.501 [8] and 3GPP TS 23.502 [9].

6.3.2.4 Network-requested PDU session modification procedure not accepted by the UE

Upon receipt of a PDU SESSION MODIFICATION COMMAND message and a PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5, if the UE rejects the PDU SESSION MODIFICATION COMMAND message, the UE shall create a PDU SESSION MODIFICATION COMMAND REJECT message.

If the PDU SESSION MODIFICATION COMMAND message contains the PTI value allocated in the UE-requested PDU session modification procedure, the UE shall stop the timer T3581. The UE should ensure that the PTI value assigned to this procedure is not released immediately.

NOTE 1: The way to achieve this is implementation dependent. For example, the UE can ensure that the PTI value assigned to this procedure is not released during the time equal to or greater than the default value of timer T3591.

While the PTI value is not released, the UE regards any received PDU SESSION MODIFICATION COMMAND message with the same PTI value as a network retransmission (see subclause 7.3.1).

The UE shall set the 5GSM cause IE of the PDU SESSION MODIFICATION COMMAND REJECT message to indicate the reason for rejecting the PDU session modification.

The 5GSM cause IE typically indicates one of the following 5GSM cause values:

#26 insufficient resources;

#44 semantic error in packet filter(s);

#45 syntactical error in packet filter(s);

#83 semantic error in the QoS operation; or

#84 syntactical error in the QoS operation.

If the selected SSC mode of the PDU session is "SSC mode 3" and the PDU SESSION MODIFICATION COMMAND messages includes 5GSM cause #39 "reactivation requested", while the UE does not have sufficient resources for initiating the PDU session establishment procedure as specified in subclause 6.4.1 then the UE shall set cause IE to #26 "insufficient resources".

If the PDU SESSION MODIFICATION COMMAND message includes a request to add a new authorized QoS rule, or a request to modify the authorized QoS rules, or both, and the UE decides to reject the request due to e.g. the supported number of authorized QoS rules or number of packet filters associated with a PDU session having reached the maximum number, then the UE shall set the 5GSM cause IE to #26 "insufficient resources".

NOTE 2: The maximum number of supported authorized QoS rules or packet filters associated with a PDU session is implementation specific.

If the PDU SESSION MODIFICATION COMMAND message includes a request to add a new authorized QoS flow description, or a request to modify the authorized QoS flow descriptions, or both and the UE decides to reject the request due to e.g. the supported number of authorized QoS flow descriptions, then the UE shall set the 5GSM cause IE to #26 "insufficient resources".

NOTE 3: The maximum number of supported authorized QoS flow descriptions associated with a PDU session is implementation specific.

If the PDU SESSION MODIFICATION COMMAND message includes the Authorized QoS rules IE, the UE shall process the QoS rules sequentially starting with the first QoS rule. The UE shall check the QoS rule and the QoS flow description provided in the PDU SESSION MODIFICATION COMMAND message for different types of errors as follows:

NOTE 4: If an error is detected in a QoS rule or a QoS flow description which requires rejecting the PDU SESSION MODIFICATION COMMAND message, then the Authorized QoS rules IE, the Authorized QoS flow descriptions IE, the Mapped EPS bearer contexts IE and any other IE (RQ timer value IE, Always-on PDU session indication IE, etc) included in the PDU SESSION MODIFICATION COMMAND message are discarded, if any.

a) Semantic errors in QoS operations:

   1) When the rule operation is "Modify existing QoS rule and add packet filters", "Modify existing QoS rule and replace all packet filters", "Modify existing QoS rule and delete packet filters" or "Modify existing QoS rule without modifying packet filters" on the default QoS rule and the DQR bit is set to "the QoS rule is not the default QoS rule".

   2) When the rule operation is "Modify existing QoS rule and add packet filters", "Modify existing QoS rule and replace all packet filters", "Modify existing QoS rule and delete packet filters" or "Modify existing QoS rule without modifying packet filters" on a QoS rule which is not the default QoS rule and the DQR bit is set to "the QoS rule is the default QoS rule".

   3) When the rule operation is "Create new QoS rule" and the DQR bit is set to "the QoS rule is the default QoS rule" when there's already a default QoS rule with different QoS rule identifier.

   4) When the rule operation is "Delete existing QoS rule" on the default QoS rule.

5) When the rule operation is "Create new QoS rule", "Modify existing QoS rule and add packet filters", "Modify existing QoS rule and replace all packet filters", "Modify existing QoS rule and delete packet filters ", or "Modify existing QoS rule without modifying packet filters" and two or more QoS rules associated with this PDU session would have identical precedence values, and the UE is not in NB-N1 mode.

6) When the rule operation is "Modify existing QoS rule and delete packet filters", the QoS rule is a QoS rule of a PDU session of IPv4, IPv6, IPv4v6 or Ethernet PDU session type, and the packet filter list in the resultant QoS rule is empty.

7) When the rule operation is "Create new QoS rule", there is already an existing QoS rule with the same QoS rule identifier and the UE is not in NB-N1 mode.

8) When the rule operation is "Modify existing QoS rule and add packet filters", "Modify existing QoS rule and replace all packet filters", "Modify existing QoS rule and delete packet filters" or "Modify existing QoS rule without modifying packet filters", the associated QoS rule does not exist and the UE is not in NB-N1 mode.

9) When the rule operation is different than "Delete existing QoS rule", the DQR bit of the QoS rule is set to "the QoS rule is not the default QoS rule" and the UE is in NB-N1 mode.

10) When the rule operation is "Create new QoS rule", the DQR bit is set to "the QoS rule is not the default QoS rule", and the PDU session type of the PDU session is "Unstructured".

11) When the rule operation is "Delete existing QoS rule" and there is no existing QoS rule with the same QoS rule identifier.

12) When the flow description operation is "Create new QoS flow description", there is already an existing QoS flow description with the same QoS flow identifier and the UE is not in NB-N1 mode.

13) When the flow description operation is "Modify existing QoS flow description", the associated QoS flow description does not exist and the UE is not in NB-N1 mode.

14) When the flow description operation is "Delete existing QoS flow description" and there is no existing QoS flow description with the same QoS flow identifier.

15) When the flow description operation is different than "Delete existing QoS flow description", the QFI is not the same as the QFI of the default QoS rule and the UE is in NB-N1 mode.

16) When the flow description operation is "Create new QoS flow description" or "Modify existing QoS flow description", the QFI associated with the QoS flow description is not the same as the QFI of the default QoS rule, and the PDU session type of the PDU session is "Unstructured".

17) When the rule operation is "Modify existing QoS rule and add packet filters", the "packet filter list" field contains a match-all packet filter, the resultant QoS rule is the default QoS rule and there is already an existing match-all packet filter associated with the default QoS rule.

18) When the rule operation is "Create new QoS rule" and the DQR bit is set to "the QoS rule is not the default QoS rule", or the rule operation is "Modify existing QoS rule and add packet filters" on a QoS rule which is not the default QoS rule or "Modify existing QoS rule and replace all packet filters" on a QoS rule which is not the default QoS rule, and one match-all packet filter is to be associated with the resultant QoS rule.

In case 4, the UE shall initiate a PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #83 "semantic error in the QoS operation".

In case 5, if the old QoS rule (i.e. the QoS rule that existed before the PDU SESSION MODIFICATION COMMAND message was received) is not the default QoS rule, the UE shall not diagnose an error, shall further process the new request and, if it was processed successfully, shall delete the old QoS rule which has identical precedence value. Furthermore, after sending the PDU SESSION MODIFICATION COMPLETE for the ongoing PDU session modification procedure, the UE shall send a PDU SESSION MODIFICATION REQUEST message with 5GSM cause #83 "semantic error in the QoS operation" to delete the QoS rule.

In case 5, if the old QoS rule (i.e. the QoS rule that existed before the PDU SESSION MODIFICATION COMMAND message was received) is the default QoS rule, the UE shall initiate a PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #83 "semantic error in the QoS operation".

In case 6, if the QoS rule is not the default QoS rule, after sending the PDU SESSION MODIFICATION COMPLETE for the ongoing PDU session modification procedure, the UE shall send a PDU SESSION MODIFICATION REQUEST message with 5GSM cause #83 "semantic error in the QoS operation" to delete the QoS rule.

In case 6, if the QoS rule is the default QoS rule, the UE shall initiate a PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #83 "semantic error in the QoS operation".

In case 7, if the existing QoS rule is not the default QoS rule and the DQR bit of the new QoS rule is set to "the QoS rule is not the default QoS rule", the UE shall not diagnose an error, further process the create request and, if it was processed successfully, delete the old QoS rule (i.e. the QoS rule that existed when case 7 was detected). If the existing QoS rule is the default QoS rule or the DQR bit of the new QoS rule is set to "the QoS rule is the default QoS rule", the UE shall reject the PDU SESSION MODIFICATION COMMAND message with 5GSM cause #83 "semantic error in the QoS operation".

In case 9 or case 10, after sending the PDU SESSION MODIFICATION COMPLETE for the ongoing PDU session modification procedure, the UE shall send a PDU SESSION MODIFICATION REQUEST message with 5GSM cause #83 "semantic error in the QoS operation" to delete the QoS rule.

In case 11, the UE shall not diagnose an error, further process the delete request and, if it was processed successfully, consider the respective QoS rule as successfully deleted.

In case 12, the UE shall not diagnose an error, further process the create request and, if it was processed successfully, delete the old QoS flow description (i.e. the QoS flow description that existed when case 12 was detected).

In case 14, the UE shall not diagnose an error, further process the delete request and, if it was processed successfully, consider the respective QoS flow description as successfully deleted.

In case 15 or case 16, after sending the PDU SESSION MODIFICATION COMPLETE for the ongoing PDU session modification procedure, the UE shall send a PDU SESSION MODIFICATION REQUEST message with 5GSM cause #83 "semantic error in the QoS operation" to delete the QoS flow description.

Otherwise, the UE shall reject the PDU SESSION MODIFICATION COMMAND message with 5GSM cause #83 "semantic error in the QoS operation".

b) Syntactical errors in QoS operations:

1) When the rule operation is "Create new QoS rule", "Modify existing QoS rule and add packet filters", "Modify existing QoS rule and replace all packet filters" or "Modify existing QoS rule and delete packet filters", the PDU session type of the PDU session is IPv4, IPv6, IPv4v6 or Ethernet PDU session type, and the packet filter list in the QoS rule is empty.

2) When the rule operation is "Delete existing QoS rule" or "Modify existing QoS rule without modifying packet filters" with a non-empty packet filter list in the QoS rule.

3) When the rule operation is "Modify existing QoS rule and delete packet filters" and the packet filter to be deleted does not exist in the original QoS rule.

4) Void.

5) When there are other types of syntactical errors in the coding of the Authorized QoS rules IE or the Authorized QoS flow descriptions IE, such as: a mismatch between the number of packet filters subfield and the number of packet filters in the packet filter list when the rule operation is "delete existing QoS rule" or "create new QoS rule", or the number of packet filters subfield is larger than the maximum possible number of packet filters in the packet filter list (i.e., there is no QoS rule precedence subfield included in the QoS rule IE), the QoS Rule Identifier is set to "no QoS rule identifier assigned" when the rule operation is not "delete existing QoS rule", or the QoS flow identifier is set to "no QoS flow identifier assigned" when the flow description operation is not "Delete existing QoS flow description".

6) When the rule operation is "Modify existing QoS rule and add packet filters" or "Modify existing QoS rule and replace all packet filters", the DQR bit is set to "the QoS rule is the default QoS rule", the PDU session type of the PDU session is "Unstructured", and the packet filter list in the QoS rule is not empty.

7) When, the

A) rule operation is "Create new QoS rule", "Modify existing QoS rule and add packet filters", "Modify existing QoS rule and replace all packet filters", "Modify existing QoS rule and delete packet filters" or "Modify existing QoS rule without modifying packet filters", there is no QoS flow description with a QFI corresponding to the QFI of the resulting QoS rule and the UE determines, by using the QoS rule's QFI as the 5QI, that there is a resulting QoS rule for a GBR QoS flow (as described in 3GPP TS 23.501 [8] table 5.7.4-1).

B) flow description operation is "Delete existing QoS flow description", and the UE determines, by using the QoS rule's QFI as the 5QI, that there is a resulting QoS rule for a GBR QoS flow (as described in 3GPP TS 23.501 [8] table 5.7.4-1) with a QFI corresponding to the QFI of the QoS flow description that is deleted (i.e. there is no associated QoS flow description with the same QFI).

8) When the flow description operation is "Create new QoS flow description" or "Modify existing QoS flow description", and the UE determines that there is a QoS flow description of a GBR QoS flow (as described in 3GPP TS 23.501 [8] table 5.7.4-1) which lacks at least one of the mandatory parameters (i.e., GFBR uplink, GFBR downlink, MFBR uplink and MFBR downlink). If the QoS flow description does not include a 5QI, the UE determines this by using the QFI as the 5QI,

In case 3 the UE shall not diagnose an error, further process the deletion request and, if no error according to items c and d was detected, consider the respective packet filter as successfully deleted.

In case 6, after completion of the PDU session modification procedure, the UE shall send a PDU SESSION MODIFICATION REQUEST message with 5GSM cause #84 "syntactical error in the QoS operations" to delete all the packet filters for the default QoS rule.

In case 7, if the Authorized QoS rules IE contains at least one other valid QoS rule, the UE shall not diagnose an error and shall further process the request, if no error according to items c and d was detected. After completion of the PDU session modification procedure, if the resulting QoS rule for a GBR QoS flow which has no QoS flow description is the default QoS rule, the UE shall initiate a PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #84 "syntactical error in the QoS operation". Otherwise, the UE shall delete the QoS rule for which no corresponding QoS flow description is available and initiate UE-requested PDU session modification procedure with 5GSM cause #84 "syntactical error in the QoS operation" to delete the QoS rule for which it has deleted.

In case 8, if the default QoS rule is associated with the QoS flow description which lacks at least one of the mandatory parameters, the UE shall initiate a PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #84 "syntactical error in the QoS operation". Otherwise, if the Authorized QoS rules IE contains at least one other valid QoS rule or the QoS flow description IE contains at least one other valid QoS flow description, the UE shall not diagnose an error and shall further process the request, if no error according to items c and d was detected. After completion of the PDU session modification procedure, the UE shall delete the QoS flow description which lacks at least one of the mandatory parameters and the associated QoS rule(s), if any, and initiate UE-requested PDU session modification procedure with 5GSM cause #84 "syntactical error in the QoS operation" to delete the QoS flow description and the associated QoS rule(s), if any, which it has deleted.

Otherwise the UE shall reject the PDU SESSION MODIFICATION COMMAND message with 5GSM cause #84 "syntactical error in the QoS operation".

NOTE 5: It is not considered an error if the UE determines that after processing all QoS operations on QoS rules and QoS flow descriptions there is a QoS flow description that is not associated with any QoS rule and the UE is not in NB-N1 mode.

NOTE 5a: An implementation that strictly follows QoS rule operation as defined in subclause 9.11.4.13 might not detect case 2).

c) Semantic errors in packet filters:

1) When a packet filter consists of conflicting packet filter components which would render the packet filter ineffective, i.e. no IP packet will ever fit this packet filter. How the UE determines a semantic error in a packet filter is outside the scope of the present document.

The UE shall reject the PDU SESSION MODIFICATION COMMAND message with 5GSM cause #44 "semantic error in packet filter(s)".

d) Syntactical errors in packet filters:

1) When the rule operation is "Create new QoS rule", "Modify existing QoS rule and add packet filters" or "Modify existing QoS rule and replace all packet filters", and two or more packet filters in the resultant QoS rule would have identical packet filter identifiers.

2) When there are other types of syntactical errors in the coding of packet filters, such as the use of a reserved value for a packet filter component identifier.

In case 1, if two or more packet filters with identical packet filter identifiers are contained in the PDU SESSION MODIFICATION COMMAND message, the UE shall reject the PDU SESSION MODIFICATION COMMAND with 5GSM cause #45 "syntactical errors in packet filter(s)". Otherwise, the UE shall not diagnose an error, further process the PDU SESSION MODIFICATION COMMAND message and, if it was processed successfully, replace the old packet filter with the new packet filter which have the identical packet filter identifiers.

Otherwise the UE shall reject the PDU SESSION MODIFICATION COMMAND message with 5GSM cause #45 "syntactical errors in packet filter(s)".

If:

a) the UE detects errors in QoS rules that require to delete at least one QoS rule as described above which requires sending a PDU SESSION MODIFICATION REQUEST message to delete the erroneous mapped EPS bearer contexts; and

b) optionally, if the UE detects different errors in the mapped EPS bearer contexts as described in subclause 6.3.2.3 which requires sending a PDU SESSION MODIFICATION REQUEST message to delete the erroneous QoS rules;

the UE, after sending the PDU SESSION MODIFICATION COMPLETE message for the ongoing PDU session modification procedure, may send a single PDU SESSION MODIFICATION REQUEST message to delete the erroneous QoS rules, and optionally to delete the erroneous mapped EPS bearer contexts. The UE shall include a 5GSM cause IE in the PDU SESSION MODIFICATION REQUEST message.

NOTE 6: The 5GSM cause to use cannot be different from #41 "semantic error in the TFT operation", #42 "syntactical error in the TFT operation", #44 "semantic error in packet filter(s)", #45 "syntactical errors in packet filter(s)", #83 "semantic error in the QoS operation", #84 "syntactical error in the QoS operation", or #85 "Invalid mapped EPS bearer identity". The selection of a 5GSM cause is up to UE implementation.

The UE shall transport the PDU SESSION MODIFICATION COMMAND REJECT message and the PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5.

Upon receipt of a PDU SESSION MODIFICATION COMMAND REJECT message with 5GSM cause value in state PDU SESSION MODIFICATION PENDING, the SMF shall stop timer T3591, enter the state PDU SESSION ACTIVE and abort the PDU session modification procedure.

6.3.2.5 Abnormal cases on the network side

The following abnormal cases can be identified:

a) Expiry of timer T3591.

On the first expiry of the timer T3591, the SMF shall resend the PDU SESSION MODIFICATION COMMAND message and shall reset and restart timer T3591. This retransmission is repeated four times, i.e. on the fifth expiry of timer T3591, the SMF shall abort the procedure and enter the state PDU SESSION ACTIVE.

The SMF may continue to use the previous configuration of the PDU session or initiate the network-requested PDU session release procedure. If the SMF decides to continue to use the previous configuration of the PDU session and

i) the Authorized QoS rules IE is included in the PDU SESSION MODIFICATION COMMAND message, the SMF may mark the corresponding authorized QoS rule(s) of the PDU session as to be synchronised with the UE; and

ii) the Authorized QoS flow descriptions IE is included in the PDU SESSION MODIFICATION COMMAND message, the SMF may mark the corresponding authorized QoS flow description(s) of the PDU session as to be synchronised with the UE.

b) Void.

c) Collision of UE-requested PDU session release procedure and network-requested PDU session modification procedure.

If the SMF receives a PDU SESSION RELEASE REQUEST message during the network-requested PDU session modification procedure, and the PDU session indicated in the PDU SESSION RELEASE REQUEST message is the PDU session that the SMF had requested to modify, the SMF shall abort the PDU session modification procedure and proceed with the UE-requested PDU session release procedure.

d) Collision of UE-requested PDU session modification procedure and network-requested PDU session modification procedure.

If the network receives a PDU SESSION MODIFICATION REQUEST message during the network-requested PDU session modification procedure, and the PDU session indicated in the PDU SESSION MODIFICATION REQUEST message is the PDU session that the network had requested to modify, the network shall:

i) if the received PDU SESSION MODIFICATION REQUEST message includes the URSP rule enforcement reports IE, ignore the PDU SESSION MODIFICATION REQUEST message received in the state PDU SESSION MODIFICATION PENDING except for the URSP rule enforcement reports IE and proceed with the network-requested PDU session modification procedure; or

ii) otherwise, ignore the PDU SESSION MODIFICATION REQUEST message received in the state PDU SESSION MODIFICATION PENDING and proceed with the network-requested PDU session modification procedure as if no PDU SESSION MODIFICATION REQUEST message was received from the UE.

e) 5G access network cannot forward the message.

If the SMF determines based on content of the n2SmInfo attribute specified in 3GPP TS 29.502 [20A] that the DL NAS TRANSPORT message carrying the PDU SESSION MODIFICATION COMMAND message was not forwarded to the UE by the 5G access network, then the SMF shall abort the procedure and enter the state PDU SESSION ACTIVE.

f) 5G access network cannot forward the message due to handover.

If the SMF determines based on content of the n2SmInfo attribute specified in 3GPP TS 29.502 [20A] that the DL NAS TRANSPORT message carrying the PDU SESSION MODIFICATION COMMAND message was not forwarded to the UE by the 5G access network due to handover, then the SMF shall abort the procedure and enter the state PDU SESSION ACTIVE.

The SMF may re-initiate, up to a pre-configured number of times, the network-requested PDU session modification procedure when the SMF detects that the handover is completed successfully or has failed or at the expiry of the configured guard timer as specified in 3GPP TS 23.502 [9].

g) Collision of re-establishment of the user-plane resources and network-requested PDU session modification procedure for the same PDU session.

If the SMF receives an indication from the AMF to re-establish the user-plane resources during the network-requested PDU session modification procedure for the same PDU session, the network shall abort the network-requested PDU session modification procedure and proceed with re-establishment of the user-plane resources for the PDU session as specified in 3GPP TS 29.502 [20A] subclause 5.2.2.3.2.2.

NOTE: After the completion of re-establishment of the user-plane resources for the PDU session, the SMF can re-initiate the network-requested PDU session modification procedure for the PDU session.

h) Collision of UE-requested PDU session establishment procedure and network-requested PDU session modification procedure.

If the network receives a PDU SESSION ESTABLISHMENT REQUEST message with request type set to "existing PDU session" or "existing emergency PDU session" during the network-requested PDU session modification procedure, and the PDU session ID indicated in the PDU SESSION ESTABLISHMENT REQUEST message is the PDU session that the network had requested to modify, the network shall abort the network-requested PDU session modification procedure and proceed with the UE-requested PDU session establishment procedure.

6.3.2.6 Abnormal cases in the UE

The following abnormal cases can be identified:

a) PDU session inactive for the received PDU session ID.

   If the PDU session ID in the PDU SESSION MODIFICATION COMMAND message belongs to any PDU session in state PDU SESSION INACTIVE in the UE, the UE shall set the 5GSM cause IE to #43 "Invalid PDU session identity" in the 5GSM STATUS message, and set the PDU session ID to the received PDU session ID in the UL NAS TRANSPORT message as specified in subclause 5.4.5.

b) Collision of network-requested PDU session modification procedure and UE-requested PDU session modification procedure.

   If the UE receives a PDU SESSION MODIFICATION COMMAND message during the UE-requested PDU session modification procedure, the PTI IE of the PDU SESSION MODIFICATION COMMAND message is set to "No procedure transaction identity assigned", and the PDU session indicated in the PDU SESSION MODIFICATION COMMAND message is the PDU session that the UE had requested to modify, the UE shall abort internally the UE-requested PDU session modification procedure, enter the state PDU SESSION ACTIVE and proceed with the network-requested PDU session modification procedure.

c) A semantic error in QoS operations or a sematic error in packet filters is detected in a PDU SESSION MODIFICATION COMMAND message that contains other optional information elements.

   If the UE diagnoses a semantic error in QoS operations or a semantic error in packet filters in the PDU SESSION MODIFICATION COMMAND, as specified in subclause 6.3.2.4, and the message contains other optional information elements, the UE shall discard the other optional information elements and shall send the PDU SESSION MODIFICATION REJECT message as specified in subclause 6.3.2.4.

6.3.3 Network-requested PDU session release procedure

6.3.3.1 General

The purpose of the network-requested PDU session release procedure is to enable the network to release a PDU session or the user-plane resources on a single access of an MA PDU session.

6.3.3.2 Network-requested PDU session release procedure initiation

In order to initiate the network-requested PDU session release procedure, the SMF shall create a PDU SESSION RELEASE COMMAND message.

The SMF shall set the 5GSM cause IE of the PDU SESSION RELEASE COMMAND message to indicate the reason for releasing the PDU session.

The 5GSM cause IE typically indicates one of the following 5GSM cause values:

#8 operator determined barring;

#26 insufficient resources;

#29 user authentication or authorization failed;

#36 regular deactivation;

#38 network failure;

#39 reactivation requested;

#46 out of LADN service area;

#67 insufficient resources for specific slice and DNN;

#69 insufficient resources for specific slice.

If the selected SSC mode of the PDU session is "SSC mode 2" and the SMF requests the relocation of SSC mode 2 PDU session anchor with different PDU sessions as specified in 3GPP TS 23.502 [9], the SMF shall include 5GSM cause #39 "reactivation requested". If the selected SSC mode of the PDU session is "SSC mode 2" or "SSC mode 1", the S-NSSAI or the mapped S-NSSAI of the PDU session needs to be replaced, the SMF shall include the Alternative S-NSSAI IE and 5GSM cause #39 "reactivation requested" in the PDU SESSION RELEASE COMMAND message. If the selected SSC mode of the PDU session is "SSC mode 2" or "SSC mode 1", replaced S-NSSAI is available and the SMF determines that the PDU session needs to be re-established on the replaced S-NSSAI, the SMF shall include 5GSM cause #39 "reactivation requested" and the replaced S-NSSAI in the PDU SESSION RELEASE COMMAND message.

NOTE 1: The relocation of SSC mode 2 PDU session anchor with different PDU sessions can also be initiated by the SMF in case of the SMF is requested by the AMF to release the PDU session due to the network slice instance of the PDU session is changed as specified in subclause 5.15.5.3 of 3GPP TS 23.501 [8].

If the network-requested PDU session release procedure is triggered by a UE-requested PDU session release procedure, the SMF shall set the PTI IE of the PDU SESSION RELEASE COMMAND message to the PTI of the PDU SESSION RELEASE REQUEST message received as part of the UE-requested PDU session release procedure and shall not include the Access type IE in the PDU SESSION RELEASE COMMAND.

If the network-requested PDU session release procedure is not triggered by a UE-requested PDU session release procedure, the SMF shall set the PTI IE of the PDU SESSION RELEASE COMMAND message to "No procedure transaction identity assigned".

If the PDU session ID included in PDU SESSION RELEASE COMMAND message is associated with one or more multicast MBS sessions and either the Access type IE is not included or the Access type IE indicates "3GPP access", the SMF shall consider the UE as removed from the associated multicast MBS sessions.

Based on the local policy and user's subscription data, if the SMF decides to release the PDU session after determining:

a) the UE has moved between a tracking area in NB-N1 mode and a tracking area in WB-N1 mode;

b) the UE has moved between a tracking area in NB-S1 mode and a tracking area in WB-N1 mode;

c) the UE has moved between a tracking area in WB-S1 mode and a tracking area in NB-N1 mode; or

d) a PDU session is not only for control plane CIoT 5GS optimization any more,

the SMF shall:

a) include the 5GSM cause value #39 "reactivation requested" in the 5GSM cause IE of the PDU SESSION RELEASE COMMAND message; or

b) include a 5GSM cause value other than #39 "reactivation requested" in the 5GSM cause IE of the PDU SESSION RELEASE COMMAND message.

NOTE 2: The included 5GSM cause value is up to the network implementation.

If the SMF receives UE presence in LADN service area from the AMF indicating that the UE is out of the LADN service area and the SMF decides to release the PDU session, the SMF shall include the 5GSM cause value #46 "out of LADN service area" in the 5GSM cause IE of the PDU SESSION RELEASE COMMAND message. Upon receipt of the 5GSM cause value #46 "out of LADN service area" in the 5GSM cause IE of the PDU SESSION RELEASE COMMAND message, the UE shall release the PDU session.

The SMF may include a Back-off timer value IE in the PDU SESSION RELEASE COMMAND message when the 5GSM cause value #26 "insufficient resources" is included in the PDU SESSION RELEASE COMMAND message. If the 5GSM cause value is #26 "insufficient resources" and the PDU SESSION RELEASE COMMAND message is sent to a UE configured for high priority access in selected PLMN or SNPN or the request type was set to "initial emergency

request" or "existing emergency PDU session" for the establishment of the PDU session, the network shall not include a Back-off timer value IE.

The SMF may include a Back-off timer value IE in the PDU SESSION RELEASE COMMAND message when the 5GSM cause value #67 "insufficient resources for specific slice and DNN" is included in the PDU SESSION RELEASE COMMAND message. If the 5GSM cause value is #67 "insufficient resources for specific slice and DNN" and the PDU SESSION RELEASE COMMAND message is sent to a UE configured for high priority access in selected PLMN or SNPN or the request type was set to "initial emergency request" or "existing emergency PDU session" for the establishment of the PDU session, the network shall not include a Back-off timer value IE.

The SMF may include a Back-off timer value IE in the PDU SESSION RELEASE COMMAND message when the 5GSM cause #69 "insufficient resources for specific slice" is included in the PDU SESSION RELEASE COMMAND message. If the 5GSM cause value is #69 "insufficient resources for specific slice" and the PDU SESSION RELEASE COMMAND message is sent to a UE configured for high priority access in selected PLMN or SNPN or the request type was set to "initial emergency request" or "existing emergency PDU session" for the establishment of the PDU session, the network shall not include a Back-off timer value IE.

The SMF should include a Back-off timer value IE in the PDU SESSION RELEASE COMMAND message when the 5GSM cause value #29 "user authentication or authorization failed" is included in the PDU SESSION RELEASE COMMAND message.

If the service-level-AA procedure is triggered for the established PDU session for UAS services with re-authentication purpose, and the SMF is informed by the UAS-NF that UUAA-SM is unsuccessful or if the SMF receives UUAA revocation notification message from the UAS-NF as described in 3GPP TS 23.256 [6AB], the SMF shall transmit the PDU SESSION RELEASE COMMAND message to the UE, including:

a) the service-level-AA response in the Service-level-AA container IE, with the SLAR field set to the value of "Service level authentication and authorization was not successful or service level authorization is revoked"; and

b) the 5GSM cause value #29 "user authentication or authorization failed" in the 5GSM cause IE of the PDU SESSION RELEASE COMMAND message.

If the PDU session was established for C2 communication and the SMF is informed by UAS-NF that C2 authorization is revoked, the SMF shall include:

a) the service-level-AA response with the value of the C2AR field set to the "C2 authorization was not successful or C2 authorization is revoked" in the service-level-AA container IE of the PDU SESSION RELEASE COMMAND message, and

b) the 5GSM cause value #29 "user authentication or authorization failed" in the 5GSM cause IE of the PDU SESSION RELEASE COMMAND message.

The SMF shall send:

a) the PDU SESSION RELEASE COMMAND message; and

b) the N1 SM delivery skip allowed indication:

   1) if the SMF allows the AMF to skip sending the N1 SM container to the UE and the 5GSM cause IE is not set to #39 "reactivation requested"; or

   2) if the SMF allows the AMF to skip sending the N1 SM container to the UE and the Access type IE is not included

towards the AMF, and the SMF shall start timer T3592 (see example in figure 6.3.3.2.1).

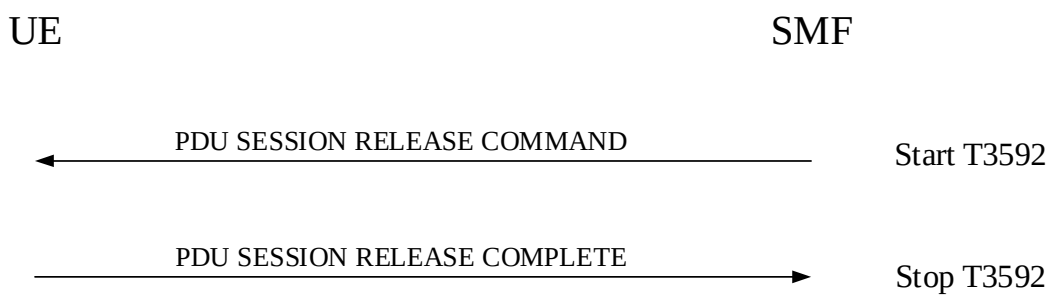


Figure 6.3.3.2.1: Network-requested PDU session release procedure

6.3.3.3 Network-requested PDU session release procedure accepted by the UE

For a single access PDU session, upon receipt of a PDU SESSION RELEASE COMMAND message and a PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5, the UE considers the PDU session as released and the UE shall create a PDU SESSION RELEASE COMPLETE message.

For an MA PDU session, upon receipt of the PDU SESSION RELEASE COMMAND message, the UE shall behave as follows:

a) if the PDU SESSION RELEASE COMMAND message includes the Access type IE and the MA PDU session has user-plane resources established on both 3GPP access and non-3GPP access, the UE shall consider the user-plane resources on the access indicated in the Access type IE as released and shall create a PDU SESSION RELEASE COMPLETE message. If the Access type IE indicates "3GPP access" and there is one or more multicast MBS sessions associated with the MA PDU session, the UE shall locally leave these associated multicast MBS sessions;

b) if the PDU SESSION RELEASE COMMAND message includes the Access type IE and the MA PDU session has user-plane resources established on only the access indicated in the Access type IE, the UE shall consider the MA PDU session as released and shall create a PDU SESSION RELEASE COMPLETE message; and

c) if the PDU SESSION RELEASE COMMAND message does not include the Access type IE, the UE shall consider the MA PDU session as released and shall create a PDU SESSION RELEASE COMPLETE message.

If the UE is configured with on-demand S-NSSAI including slice deregistration inactivity timer:

a) if the PDU session associated with an on-demand S-NSSAI is released and there is no established user plane resources of an MA PDU session associated with this on-demand S-NSSAI and there is no PDU session associated with this on-demand S-NSSAI, the UE shall start the slice deregistration inactivity timer for this on-demand S-NSSAI over the corresponding access type;

b) if the MA PDU session associated with an on-demand S-NSSAI is released:

   for each registered access type,if there is no PDU session associated with this on-demand S-NSSAI and there is no established user plane resources of an MA PDU session associated with this on-demand S-NSSAI over the registered access type, the UE shall start the slice deregistration inactivity timer for this on-demand S-NSSAI over the corresponding registered access type; or

c) if the user plane resources of an MA PDU session associated with on-demand S-NSSAI is released over the access type and there is no PDU session associated with this on-demand S-NSSAI and there is no established user plane resources of an MA PDU session associated with this on-demand S-NSSAI over the corresponding access type, then UE shall start the slice deregistration inactivity timer over the corresponding access type.

If there is one or more multicast MBS sessions associated with the PDU session the UE considers as released, the UE shall locally leave these associated multicast MBS sessions.

If the PDU SESSION RELEASE COMMAND message contains the PTI value allocated in the UE-requested PDU session release procedure, the UE shall stop the timer T3582. The UE should ensure that the PTI value assigned to this procedure is not released immediately.

NOTE 1: The way to achieve this is implementation dependent. For example, the UE can ensure that the PTI value assigned to this procedure is not released during the time equal to or greater than the default value of timer T3592.

While the PTI value is not released, the UE regards any received PDU SESSION RELEASE COMMAND message with the same PTI value as a network retransmission (see subclause 7.3.1).

If the PDU SESSION RELEASE COMMAND message includes 5GSM cause #39 "reactivation requested", then after completion of the network-requested PDU session release procedure, the UE should re-initiate the UE-requested PDU session establishment procedure as specified in subclause 6.4.1 for:

a) the PDU session type associated with the released PDU session;

b) the SSC mode associated with the released PDU session;

c) the DNN associated with the released PDU session; and

d) the S-NSSAI associated with (if available in roaming scenarios) a mapped S-NSSAI if provided in the UE-requested PDU session establishment procedure of the released PDU session. If the PDU SESSION RELEASE COMMAND message contains the Alternative S-NSSAI IE, the UE shall include both the S-NSSAI to be replaced and the alternative S-NSSAI during the UE-requested PDU session establishment procedure.

NOTE 2: User interaction is necessary in some cases when the UE cannot re-initiate the UE-requested PDU session establishment procedure automatically.

If the PDU SESSION RELEASE COMMAND message is received without the Back-off timer value IE or includes 5GSM cause #39 "reactivation requested", and the UE provided an S-NSSAI during the PDU session establishment, the UE shall stop timer T3585 if it is running for the S-NSSAI of the PDU session. If the UE did not provide an S-NSSAI 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 the timer T3585 associated with no S-NSSAI if it is running. If the PDU SESSION RELEASE COMMAND message was received for an emergency PDU session, the UE shall not stop the timer T3585 associated with no S-NSSAI if it is running. The timer T3585 to be stopped includes:

a) in a PLMN:

   1) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION RELEASE COMMAND is received, if running;

   2) the timer T3585 applied for all the PLMNs and for both 3GPP access type and non-3GPP access type, if running;

   3) the timer T3585 applied for the registered PLMN and for the access over which the PDU SESSION RELEASE COMMAND is received, if running; and

   4) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, if running; or

b) in an SNPN:

   1) the timer T3585 applied for all the equivalent SNPNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

   2) the timer T3585 applied for all the equivalent SNPNs and for both 3GPP access type and non-3GPP access type, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

   3) the timer T3585 applied for the registered SNPN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN and, if the UE supports

access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

4) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

If the PDU SESSION RELEASE COMMAND message is received without the Back-off timer value IE or includes 5GSM cause #39 "reactivation requested", and the UE provided a DNN during the PDU session establishment, the UE shall stop timer T3396 if it is running for the DNN provided by the UE. If the UE did not provide a DNN 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 the timer T3396 associated with no DNN if it is running. If the PDU SESSION RELEASE COMMAND message was received for an emergency PDU session, the UE shall not stop the timer T3396 associated with no DNN if it is running. In an SNPN, the timer T3396 to be stopped includes:

a) the timer T3396 applied for all the equivalent SNPNs, associated with the RSNPN or an equivalent SNPN, and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

b) the timer T3396 applied for the registered SNPN, associated with the RSNPN, and, if the UE supports access to an SNPN using credentials from a credentials holder, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

If the PDU SESSION RELEASE COMMAND message is received without the Back-off timer value IE or includes 5GSM cause #39 "reactivation requested", and the UE provided an S-NSSAI and a DNN during the PDU session establishment, the UE shall stop timer T3584 if it is running for the [S-NSSAI of the PDU session, DNN] combination provided by the UE. If the UE did not provide an S-NSSAI during the PDU session establishment, the UE shall stop the timer T3584 associated with [no S-NSSAI, DNN] if it is running. If the UE did not provide a DNN 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 the timer T3584 associated with [S-NSSAI of the PDU session, no DNN] combination, if it is running. If the PDU SESSION RELEASE COMMAND message was received for an emergency PDU session, the UE shall not stop the timer T3584 associated with [S-NSSAI of the PDU session, no DNN] if it is running. If the UE provided neither a DNN nor an S-NSSAI 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 the timer T3584 associated with [no S-NSSAI, no DNN] if it is running. If the PDU SESSION RELEASE COMMAND message was received for an emergency PDU session, the UE shall not stop the timer T3584 associated with [no S-NSSAI, no DNN] if it is running. The timer T3584 to be stopped includes:

a) in a PLMN:

1) the timer T3584 applied for all the PLMNs, if running; and

2) the timer T3584 applied for the registered PLMN, if running; or

b) in an SNPN:

1) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

2) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

NOTE 3: If the PDU SESSION RELEASE COMMAND message is received without the Back-off timer value IE or includes 5GSM cause #39 "reactivation requested" for a PDU session, the UE provided a DNN (or no DNN) and an S-NSSAI (or no S-NSSAI) when the PDU session is established, timer T3396 associated with the DNN (or no DNN, if no DNN was provided by the UE) is running, and timer T3584 associated with the DNN (or no DNN, if no DNN was provided by the UE) and the S-NSSAI of the PDU session (or no S-NSSAI, if no S-NSSAI was provided by the UE) is running, then the UE stops both the timer T3396 and the timer T3584.

NOTE 4: If the PDU SESSION RELEASE COMMAND message is received without the Back-off timer value IE or includes 5GSM cause #39 "reactivation requested" for a PDU session, the UE provided a DNN (or no DNN) and an S-NSSAI of the PDU session (or no S-NSSAI) when the PDU session is established, timer T3585 associated with the S-NSSAI of the PDU session (or no S-NSSAI, if no S-NSSAI was provided by the UE) is running, and timer T3584 associated with the DNN (or no DNN, if no DNN was provided by the UE) and the S-NSSAI of the PDU session (or no S-NSSAI, if no S-NSSAI was provided by the UE) is running, then the UE stops both the timer T3585 and the timer T3584.

If the PDU SESSION RELEASE COMMAND message includes 5GSM cause #26 "insufficient resources" and the Back-off timer value IE, the UE shall ignore 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:

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. In an SNPN, the timer T3396 to be stopped includes:

   1) the timer T3396 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

   2) the timer T3396 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

   The UE shall then start timer T3396 with the value provided in the Back-off timer value IE and:

   1) shall not send a 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 a PDU SESSION ESTABLISHMENT REQUEST message without an DNN and 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 a non-emergency PDU session established without an 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, SNPN 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. In an SNPN, the timer T3396 to be stopped includes:

   1) the timer T3396 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

   2) the timer T3396 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

   The UE:

   1) shall not send a 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 until the UE is switched off, the USIM is removed, the entry in the "list of subscriber data" for the

current SNPN is updated, or the UE receives a PDU SESSION MODIFICATION COMMAND message for the same DNN from the network, or a PDU SESSION AUTHENTICATION COMMAND message for the same DNN, or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE or including 5GSM cause #39 "reactivation requested" for the same DNN from the network; and

2) shall not send a 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 a 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, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated, or the UE receives a PDU SESSION MODIFICATION COMMAND message for a non-emergency PDU session established without an DNN provided by the UE, or a PDU SESSION AUTHENTICATION 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 or including 5GSM cause #39 "reactivation requested" for a non-emergency PDU session established without a DNN provided by the UE.

The timer T3396 remains deactivated upon a PLMN change, SNPN change, or inter-system change; and

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

1) shall stop timer T3396 associated with the corresponding DNN, if running. In an SNPN, the timer T3396 to be stopped includes:

i) the timer T3396 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

ii) the timer T3396 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE may send a 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. In an SNPN, the timer T3396 to be stopped includes:

i) the timer T3396 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

ii) the timer T3396 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE may send a PDU SESSION ESTABLISHMENT REQUEST message without a DNN, or a PDU SESSION MODIFICATION REQUEST message without an DNN provided by the UE.

In an SNPN, if the UE supports equivalent SNPNs, then the UE shall apply the timer T3396 for all the equivalent SNPNs. Otherwise, the UE shall apply the timer T3396 for the registered SNPN.

If the PDU SESSION RELEASE COMMAND message includes 5GSM cause #26 "insufficient resources" and the Back-off timer value IE is not included, then the UE may send a PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST message for the same DNN or without a DNN.

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 timer T3396 is running when the UE enters state 5GMM-DEREGISTERED, the UE remains switched on, and the USIM in the UE (if any) remains the same and the entry in the "list of subscriber data" for the SNPN to which timer T3396 is associated (if any) is not updated, then timer T3396 is kept running until it expires or it is stopped.

If the UE is switched off when the timer T3396 is running, and if the USIM in the UE (if any) remains the same and the entry in the "list of subscriber data" for the SNPN to which timer T3396 is associated (if any) is not updated 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 5GSM cause value is #39 "reactivation requested", the UE shall ignore the Back-off timer value IE provided by the network, if any.

If the 5GSM cause value is #67 "insufficient resources for specific slice and DNN" and the Back-off timer value IE is included, the UE shall take different actions depending on the timer value received for timer T3584 in the Back-off timer value:

a) If the timer value indicates neither zero nor deactivated, and both an S-NSSAI and a DNN were provided by the UE during the PDU session establishment the UE shall stop timer T3584 associated with the [S-NSSAI of the PDU session, DNN] combination, if it is running. If the timer value indicates neither zero nor deactivated, an S-NSSAI 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 of the PDU session, no DNN] combination, if it is running. If the timer value indicates neither zero nor deactivated, no S-NSSAI and a DNN was provided during the PDU session establishment, the UE shall stop timer T3584 associated with the [no S-NSSAI, DNN] combination, 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 the [no S-NSSAI, no DNN] combination, if it is running. The timer T3584 to be stopped includes:

   1) in a PLMN:

      i) the timer T3584 applied for all the PLMNs, if running; and

      ii) the timer T3584 applied for the registered PLMN, if running; or

   2) in an SNPN:

      i) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

      ii) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

   The UE shall then start timer T3584 with the value provided in the Back-off timer value IE.

   1) The UE 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 PDU SESSION MODIFICATION REQUEST message with the exception of those identified in subclause 6.4.2.1, for the [S-NSSAI of the PDU session, DNN] combination, 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 the exception of those identified in subclause 6.4.2.1, for the [S-NSSAI of the PDU session, no DNN] combination, 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 the exception of those identified in subclause 6.4.2.1, for the same [no S-NSSAI, DNN] combination, 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 the exception of those identified in subclause 6.4.2.1, for the same [no S-NSSAI, no DNN] combination, 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, SNPN change, or inter-system change;

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

1) if both S-NSSAI and DNN were provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [S-NSSAI of the PDU session, DNN] combination, if running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE 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 PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for the [S-NSSAI of the PDU session, DNN] combination that was sent by the UE, until the UE is switched off, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated, or the UE receives a PDU SESSION MODIFICATION COMMAND message for the [S-NSSAI of the PDU session, DNN] combination from the network, or a PDU SESSION AUTHENTICATION COMMAND message for the [S-NSSAI of the PDU session, DNN] combination from the network, or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE or including 5GSM cause #39 "reactivation requested" for the [S-NSSAI of the PDU session, DNN] combination from the network;

2) if an S-NSSAI was provided but a DNN was not provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [S-NSSAI of the PDU session, no DNN] combination, if running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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 [S-NSSAI of the PDU session, no DNN] combination, if no DNN was provided during the PDU session establishment, until the UE is switched off, the USIM is removed, the entry in the "list of subscriber data" for

the current SNPN is updated, or the UE receives an PDU SESSION MODIFICATION COMMAND message for a non-emergency PDU session established for the [S-NSSAI of the PDU session, no DNN] combination from the network, or a PDU SESSION AUTHENTICATION COMMAND message for a non-emergency PDU session established the [S-NSSAI of the PDU session, DNN] combination from the network, or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE or including 5GSM cause #39 "reactivation requested" for a non-emergency PDU session established for the [S-NSSAI of the PDU session, no DNN] combination from the network;

3) if an S-NSSAI was not provided but a DNN was provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [no S-NSSAI, DNN] combination, if running. The timer T3584 to be stopped includes:

   i) in a PLMN:

      A) the timer T3584 applied for all the PLMNs, if running; and

      B) the timer T3584 applied for the registered PLMN, if running; or

   ii) in an SNPN:

      A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

      B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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 [no S-NSSAI, DNN], if no S-NSSAI was provided during the PDU session establishment, until the UE is switched off, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated, or the UE receives an PDU SESSION MODIFICATION COMMAND message for the [no S-NSSAI, DNN] combination from the network, or a PDU SESSION AUTHENTICATION COMMAND message for the [no S-NSSAI, DNN] combination from the network, or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE or including 5GSM cause #39 "reactivation requested" for the same [no S-NSSAI, DNN] combination from the network; and

4) if neither S-NSSAI nor DNN were provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [no S-NSSAI, no DNN] combination, if running. The timer T3584 to be stopped includes:

   i) in a PLMN:

      A) the timer T3584 applied for all the PLMNs, if running; and

      B) the timer T3584 applied for the registered PLMN, if running; or

   ii) in an SNPN:

      A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

      B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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 [no S-NSSAI, no DNN] combination, if neither S-NSSAI nor DNN was provided during the PDU session establishment, until the UE is switched off, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated, or the UE receives an PDU SESSION MODIFICATION COMMAND message for a non-emergency PDU session established for the [no S-NSSAI, no DNN] combination from the network,

or a PDU SESSION AUTHENTICATION COMMAND message for a non-emergency PDU session established for the [no S-NSSAI, no DNN] combination from the network or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE or including 5GSM cause #39 "reactivation requested" for a non-emergency PDU session established for the [no S-NSSAI, no DNN] combination from the network.

The timer T3584 remains deactivated upon a PLMN change, SNPN change, or inter-system change; and

c) if the timer value indicates zero:

1) if both S-NSSAI and DNN were provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [S-NSSAI of the PDU session, DNN] combination, if running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE may send another PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST message for the [S-NSSAI of the PDU session, DNN] combination;

2) if an S-NSSAI was provided but a DNN was not provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [S-NSSAI of the PDU session, no DNN] combination, if running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE may send another PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST message for the [S-NSSAI of the PDU session, no DNN] combination if the request type was different from "initial emergency request" and different from "existing emergency PDU session";

3) if an S-NSSAI was not provided but a DNN was provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [no S-NSSAI, DNN] combination, if running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE may send another PDU SESSION ESTABLISHMENT REQUEST message, or PDU SESSION MODIFICATION REQUEST message for the [no S-NSSAI, DNN] combination; and

4) if neither S-NSSAI nor DNN were provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [no S-NSSAI, no DNN] combination, if running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE may send another PDU SESSION ESTABLISHMENT REQUEST message, or PDU SESSION MODIFICATION REQUEST message for the [no S-NSSAI, no DNN] combination if the request type was different from "initial emergency request" and different from "existing emergency PDU session".

If the 5GSM congestion re-attempt indicator IE with the ABO bit set to "The back-off timer is applied in all PLMNs or all equivalent SNPNs " is included in the PDU SESSION RELEASE COMMAND 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 or all the equivalent SNPNs. Otherwise, the UE shall apply the timer T3584 for the registered PLMN or the registered SNPN.

If the 5GSM cause value is #67 "insufficient resources for specific slice and DNN" and the Back-off timer value IE is not included, then the UE may send another PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST message for the same [S-NSSAI, 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 (if any) remains the same and the entry in the "list of subscriber data" for the SNPN to which timer T3584 is associated (if any) is not updated, 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 (if any) remains the same and the entry in the "list of subscriber data" for the SNPN to which timer T3584 is associated (if any) is not updated 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 5GSM cause value is #69 "insufficient resources for specific slice" and the Back-off timer value IE is included, the UE shall take different actions depending on the timer value received for timer T3585 in the Back-off timer value:

a) If the timer value indicates neither zero nor deactivated and an S-NSSAI was provided during the PDU session establishment, the UE shall stop timer T3585 associated with the S-NSSAI of the PDU session, 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 timer T3585 to be stopped includes:

   1) in a PLMN:

      i) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION RELEASE COMMAND is received, if running;

      ii) the timer T3585 applied for all the PLMNs and for both 3GPP access type and non-3GPP access type, if running;

      iii) the timer T3585 applied for the registered PLMN and for the access over which the PDU SESSION RELEASE COMMAND is received, if running; and

      iv) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, if running; or

   2) in an SNPN:

      i) the timer T3585 applied for all the equivalent SNPNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

      ii) the timer T3585 applied for all the equivalent SNPNs and for both 3GPP access type and non-3GPP access type, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

      iii) the timer T3585 applied for the registered SNPN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

      iv) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

   The UE shall then start timer T3585 with the value provided in the Back-off timer value IE and:

   1) if an S-NSSAI was provided by the UE during the PDU session establishment, 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 S-NSSAI of the PDU session, until timer T3585 expires or timer T3585 is stopped; and

   2) if the request type was different from "initial emergency request" and from "existing emergency PDU session", and an S-NSSAI was not provided by the UE during the PDU session establishment, the UE 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, until timer T3585 expires or timer T3585 is stopped.

   The UE shall not stop timer T3585 upon a PLMN change, SNPN 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, the UE shall stop timer T3585 associated with the S-NSSAI of the PDU session, 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 timer T3585 to be stopped includes:

1) in a PLMN:

   i) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION RELEASE COMMAND is received, if running;

   ii) the timer T3585 applied for all the PLMNs and for both 3GPP access type and non-3GPP access type, if running;

   iii) the timer T3585 applied for the registered PLMN and for current access type or both 3GPP access type and non-3GPP access type, if running; and

   iv) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, if running; or

2) in an SNPN:

   i) the timer T3585 applied for all the equivalent SNPNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

   ii) the timer T3585 applied for all the equivalent SNPNs and for both 3GPP access type and non-3GPP access type, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

   iii) the timer T3585 applied for the registered SNPN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

   iv) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

In addition:

1) if an S-NSSAI was provided by the UE during the PDU session establishment, the UE shall not send another PDU SESSION ESTABLISHMENT REQUEST, or PDU SESSION MODIFICATION REQUEST with exception of those identified in subclause 6.4.2.1, for the S-NSSAI of the PDU session until the UE is switched off, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated, or a PDU SESSION MODIFICATION COMMAND message for the S-NSSAI of the PDU session from the network, or a PDU SESSION AUTHENTICATION COMMAND message for the S-NSSAI of the PDU session from the network, or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE or including 5GSM cause #39 "reactivation requested" for the S-NSSAI of the PDU session from the network; and

2) if the request type was different from "initial emergency request" and from "existing emergency PDU session", and an S-NSSAI was not provided by the UE during the PDU session establishment, the UE 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, until the UE is switched off, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated, or 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 AUTHENTICATION 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 or including 5GSM cause #39 "reactivation requested" for a non-emergency PDU session established without an S-NSSAI provided by the UE.

The timer T3585 remains deactivated upon a PLMN change, SNPN change, or inter-system change; and

c) if the timer value indicates zero:

1) if an S-NSSAI was provided by the UE during the PDU session establishment, the UE shall stop timer T3585 associated with the S-NSSAI of the PDU session, if running. The timer T3585 to be stopped includes:

i) in a PLMN:

A) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION RELEASE COMMAND is received, if running;

B) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION RELEASE COMMAND is received, if running;

C) the timer T3585 applied for the registered PLMN and for current access type or both 3GPP access type and non-3GPP access type, if running; and

D) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, if running; or

ii) in an SNPN:

A) the timer T3585 applied for all the equivalent SNPNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

B) the timer T3585 applied for all the equivalent SNPNs and for both 3GPP access type and non-3GPP access type, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

C) the timer T3585 applied for the registered SNPN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

D) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE may send another PDU SESSION ESTABLISHMENT REQUEST, or PDU SESSION MODIFICATION REQUEST message for the S-NSSAI of the PDU session; 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

i) in a PLMN:

A) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION RELEASE COMMAND is received, if running,;

B) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION RELEASE COMMAND is received, if running;

C) the timer T3585 applied for the registered PLMN and for current access type or both 3GPP access type and non-3GPP access type, if running; and

D) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, if running; or

ii) in an SNPN:

A) the timer T3585 applied for all the equivalent SNPNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

B) the timer T3585 applied for all the equivalent SNPNs and for both 3GPP access type and non-3GPP access type, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

C) the timer T3585 applied for the registered SNPN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

D) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE 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 with the ABO bit set to "The back-off timer is applied in all PLMNs or all equivalent SNPNs " is included in the PDU SESSION RELEASE COMMAND message with the 5GSM cause value #69 "insufficient resources for specific slice", then the UE shall apply the timer T3585 for all the PLMNs or all the equivalent SNPNs. Otherwise, the UE shall apply the timer T3585 for the registered PLMN or the registered SNPN.

If the 5GSM cause value is #69 "insufficient resources for specific slice" and the Back-off timer value IE is not included, 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 (if any) remains the same and the entry in the "list of subscriber data" for the SNPN to which timer T3585 is associated (if any) is not updated, 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 (if any) remains the same and the entry in the "list of subscriber data" for the SNPN to which timer T3585 is associated (if any) is not updated 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.

NOTE 5: As described in this subclause, upon PLMN change, SNPN 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 or SNPN, the S-NSSAI and optionally the DNN combination when the UE returns to the PLMN or SNPN 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 or SNPN change, if T3584 applied for the registered PLMN or the registered SNPN is running or is deactivated for an S-NSSAI, a DNN, and old PLMN or old SNPN, but T3584 is not running and is not deactivated for the S-NSSAI, the DNN, and new PLMN or new SNPN, 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 or new SNPN.

Upon PLMN change or SNPN change, if T3585 applied for the registered PLMN or the registered SNPN is running or is deactivated for an S-NSSAI and old PLMN or old SNPN, but T3585 is not running and is not deactivated for the S-

NSSAI and new PLMN or new SNPN, then the UE is allowed to send a PDU SESSION ESTABLISHMENT REQUEST message for the same S-NSSAI in the new PLMN or new SNPN.

Upon SNPN change, if T3584 applied for all the equivalent SNPNs is running or is deactivated for an S-NSSAI, a DNN, and old SNPN, but T3584 is not running and is not deactivated for the S-NSSAI, the DNN, and new non-equivalent SNPN, 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 SNPN.

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

If the PDU SESSION RELEASE COMMAND message includes 5GSM cause #29 "user authentication or authorization failed" and the Back-off timer value IE, the UE shall behave as follows:

a) if the timer value indicates neither zero nor deactivated and:

   1) if the UE provided a DNN and S-NSSAI to the network during the PDU session establishment, the UE shall start the back-off timer with the value provided in the Back-off timer value IE for the PDU session establishment procedure and:

      i) in a PLMN, [PLMN, DNN, (mapped) HPLMN S-NSSAI] combination. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same DNN and (mapped) HPLMN S-NSSAI in the current PLMN, until the back-off timer expires, the UE is switched off, or the USIM is removed; or

      ii) in an SNPN, [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, (mapped) subscribed SNPN S-NSSAI] combination. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same DNN and (mapped) subscribed SNPN S-NSSAI in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the back-off timer expires, the UE is switched off, the USIM is removed, or the selected entry of the "list of subscriber data" is updated;

   2) if the UE provided a DNN to the network during the PDU session establishment, the UE shall start the back-off timer with the value provided in the Back-off timer value IE for the PDU session establishment procedure and:

      i) in a PLMN, [PLMN, DNN] combination. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same DNN in the current PLMN, until the back-off timer expires, the UE is switched off, or the USIM is removed; or

      ii) in an SNPN, [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN] combination. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same DNN in the current PLMN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the back-off timer expires, the UE is switched off, the USIM is removed or the selected entry of the "list of subscriber data" is updated;

   3) if the UE did not provide a DNN or S-NSSAI or any of the two parameters to the network during the PDU session establishment, it shall start the back-off timer accordingly for the PDU session establishment procedure and:

      i) in a PLMN, the [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, (mapped) HPLMN S-NSSAI] or [PLMN, no DNN, no S-NSSAI] combination. Dependent on the combination, the UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, (mapped) HPLMN S-NSSAI] or [PLMN, no DNN, no S-NSSAI] combination in the current PLMN, until the back-off timer expires, the UE is switched off, or the USIM is removed; or

      ii) in an SNPN, [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI] or [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] combination. Dependent on the combination, the UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN,

no S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI] or [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] combination in the current PLMN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the back-off timer expires, the UE is switched off, the USIM is removed or the selected entry of the "list of subscriber data" is updated; or

4) if the UE did not provide a DNN to the network during the PDU session establishment, it shall start the back-off timer accordingly for the PDU session establishment procedure and:

   i) in a PLMN, the [PLMN, no DNN] combination. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same [PLMN, no DNN] in the current PLMN, until the back-off timer expires, the UE is switched off, or the USIM is removed; or

   ii) in an SNPN, [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN] combination. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN] in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the back-off timer expires, the UE is switched off, the USIM is removed, or the selected entry of the "list of subscriber data" is updated;

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

1) if the UE provided a DNN and S-NSSAI to the network during the PDU session establishment, the UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for:

   i) in a PLMN, the same DNN and (mapped) HPLMN S-NSSAI in the current PLMN, until the UE is switched off, or the USIM is removed; or

   ii) in an SNPN, the same DNN and (mapped) subscribed SNPN S-NSSAI in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the UE is switched off, or the USIM is removed, or the selected entry of the "list of subscriber data" is updated;

2) if the UE provided a DNN to the network during the PDU session establishment, the UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for:

   i) in a PLMN, the same DNN in the current PLMN, until the UE is switched off, or the USIM is removed; or

   ii) in an SNPN, the same DNN in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the UE is switched off, or the USIM is removed, or the selected entry of the "list of subscriber data" is updated;

3) if the UE did not provide a DNN or S-NSSAI or any of the two parameters to the network during the PDU session establishment, the UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for:

   i) in a PLMN, the same [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, (mapped) HPLMN S-NSSAI] or [PLMN, no DNN, no S-NSSAI] combination in the current PLMN, until the UE is switched off, or the USIM is removed; or

   ii) in an SNPN, the same [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI] or [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] combination in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the UE is switched off, or the USIM is removed, or the selected entry of the "list of subscriber data" is updated; or

4) if the UE did not provide a DNN to the network during the PDU session establishment, the UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for:

   i) in a PLMN, the same [PLMN, no DNN] in the current PLMN, until the UE is switched off, or the USIM is removed; or

ii) in an SNPN, the same [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN] combination in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the UE is switched off, or the USIM is removed, or the selected entry of the "list of subscriber data" is updated; and

c) if the timer value indicates zero, the UE may send another PDU SESSION ESTABLISHMENT REQUEST message:

1) in a PLMN, for the same combination of [PLMN, DNN, (mapped) HPLMN S-NSSAI], [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, (mapped) HPLMN S-NSSAI], or [PLMN, no DNN, no S-NSSAI] in the current PLMN; or

2) in an SNPN, for the same combination of [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, (mapped) subscribed SNPN S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI], or [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] in the current SNPN.

The UE shall not stop any back-off timer:

a) upon a PLMN or SNPN change;

b) upon an inter-system change; or

c) upon registration over another access type.

If the PDU SESSION RELEASE COMMAND message includes:

a) 5GSM cause #29 "user authentication or authorization failed"; and

b) the service-level-AA response in the Service-level-AA container IE with the SLAR field set to the value of "Service level authentication and authorization was not successful or service level authorization is revoked",

the UE shall forward the service-level-AA response to the upper layers, so the UUAA authorization data is deleted as specified in 3GPP TS 33.256 [24B].

The UE shall transport the PDU SESSION RELEASE COMPLETE message and the PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5.

Upon receipt of a PDU SESSION RELEASE COMPLETE message, the SMF shall stop timer T3592 and shall consider the PDU session as released.

6.3.3.4 N1 SM delivery skipped

If the PDU SESSION RELEASE COMMAND message was sent along the N1 SM delivery skip allowed indication towards AMF, then upon receipt of an indication that N1 SM delivery was skipped, the SMF shall stop timer T3592 and shall consider the PDU session as released.

6.3.3.5 Abnormal cases on the network side

The following abnormal cases can be identified:

a) Expiry of timer T3592.

The SMF shall, on the first expiry of the timer T3592, retransmit the PDU SESSION RELEASE COMMAND message and shall reset and start timer T3592. This retransmission is repeated four times, i.e. on the fifth expiry of timer T3592, the SMF shall abort the procedure.

b) Collision of network-requested PDU session release procedure and UE-requested PDU session modification procedure.

When the SMF receives a PDU SESSION MODIFICATION REQUEST message during the network-requested PDU session release procedure, and the PDU session indicated in PDU SESSION MODIFICATION REQUEST

message is the PDU session that the SMF had requested to release, the SMF shall ignore the PDU SESSION MODIFICATION REQUEST message and proceed with the PDU session release procedure.

c) Collision of network-requested PDU session release procedure and UE-requested PDU session release procedure.

If the SMF receives a PDU SESSION RELEASE REQUEST message after sending a PDU SESSION RELEASE COMMAND message with the PTI IE set to "No procedure transaction identity assigned" to the UE, and the PDU session ID in the PDU SESSION RELEASE REQUEST message is the same as the PDU session ID in the PDU SESSION RELEASE COMMAND message:

- if the Access type IE is included in the PDU SESSION RELEASE COMMAND message and the PDU session is an MA PDU session and having user-plane resources established on the access different from the access indicated in the Access type IE in the PDU SESSION RELEASE COMMAND message, the SMF shall proceed both the UE-requested PDU session release procedure and network-requested PDU session release procedure;

- otherwise, the SMF shall ignore the PDU SESSION RELEASE REQUEST message and proceed with the network-requested PDU session release procedure.

d) Collision of re-establishment of the user-plane resources and network-requested PDU session release procedure for the same PDU session.

If the SMF receives an indication from the AMF to re-establish the user-plane resources during the network-requested PDU session release procedure for the same PDU session, the SMF shall not re-establish the user-plane resources for the PDU session as specified in 3GPP TS 29.502 [20A] subclause 5.2.2.3.2.2 and proceed with the network-requested PDU session release procedure.

6.3.3.6 Abnormal cases in the UE

The following abnormal cases can be identified:

a) PDU session inactive for the received PDU session ID.

If the PDU session ID in the PDU SESSION RELEASE COMMAND message belongs to any PDU session in state PDU SESSION INACTIVE in the UE, the UE shall include the 5GSM cause #43 "Invalid PDU session identity" in the 5GSM STATUS message, and set the PDU session ID to the received PDU session ID in the UL NAS TRANSPORT message as specified in subclause 5.4.5.

b) User-plane resources of the MA PDU session on the access indicated in the Access type IE not established.

If the PDU session is an MA PDU session and has user-plane resources established on a single access different from the access indicated in the Access type IE, the UE shall not diagnose an error, further process the release command and consider the user-plane resources of the MA PDU session on the access indicated in the Access type IE as successfully released.

6.4 UE-requested 5GSM procedures

6.4.1 UE-requested PDU session establishment procedure

6.4.1.1 General

The purpose of the UE-requested PDU session establishment procedure is to establish a new PDU session with a DN, to perform handover of an existing PDU session between 3GPP access and non-3GPP access, to transfer an existing PDN connection in the EPS to the 5GS, to transfer an existing PDN connection in an untrusted non-3GPP access connected to the EPC to the 5GS, or to establish an MA PDU session to support ATSSS (see 3GPP TS 24.193 [13B]), or to relay the service associated with the RSC for 5G ProSe layer-3 UE-to-network relay (see 3GPP TS 24.554 [19E]). If accepted by the network, the PDU session enables exchange of PDUs between the UE and the DN.

The UE shall not request a PDU session establishment:

a) for an LADN, if the DNN used for that LADN is included in the LADN information IE and the UE is located outside the LADN service area indicated in the LADN information IE;

a1) for an LADN, if the DNN used for that LADN is included in the Extended LADN information IE and there is no S-NSSAI used for PDU session establishment;

a2) for an LADN, if the DNN used for that LADN is included in the Extended LADN information IE and the S-NSSAI used for PDU session establishment is not associated with that LADN;

a3) for an LADN, if the DNN and the S-NSSAI used for that LADN are included in the Extended LADN information IE and the UE is located outside the LADN service area indicated in the Extended LADN information IE;

b) to transfer a PDU session from non-3GPP access to 3GPP access when the 3GPP PS data off UE status is "activated" and the UE is not using the PDU session to send uplink IP packets for any of the 3GPP PS data off exempt services (see subclause 6.2.10);

c) when the UE is in NB-N1 mode, the UE has indicated preference for user plane CIoT 5GS optimization, the network has accepted the use of user plane CIoT 5GS optimization for the UE, and the number of PDU sessions that currently has user-plane resources established equals to the UE's maximum number of supported user-plane resources;

d) to transfer a PDU session from 3GPP access to non-3GPP access when the UE has indicated preference for control plane CIoT 5GS optimization, the network has accepted the use of control plane CIoT 5GS optimization for the UE, and the Control plane only indication IE was received in the PDU SESSION ESTABLISHMENT ACCEPT message;

e) to transfer a PDU session from the non-3GPP access to the 3GPP access when the UE is in NB-N1 mode, the UE has indicated preference for user plane CIoT 5GS optimization, the network has accepted the use of user plane CIoT 5GS optimization for the UE, and the number of PDU sessions that currently has user-plane resources established equals to the UE's maximum number of supported user-plane resources;

f) associated to an S-NSSAI when the UE is not in the NS-AoS of the S-NSSAI; or

g) associated to an S-NSSAI included in the partially allowed NSSAI when the current TA is not in the list of TAs where the S-NSSAI is allowed.

6.4.1.2 UE-requested PDU session establishment procedure initiation

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

NOTE 0: When IMS voice is available over either 3GPP access or non-3GPP access, the "voice centric" UE in 5GMM-REGISTERED state will receive a request from upper layers to establish the PDU session for IMS signalling, if the conditions for performing an initial registration with IMS indicated in 3GPP TS 24.229 [14] subclause U.3.1.2 are satisfied.

If the UE requests to establish a new PDU session, the UE shall allocate a PDU session ID which is not currently being used by another PDU session over either 3GPP access or non-3GPP access. If the N5CW device supporting 3GPP access requests to establish a new PDU session via 3GPP access, the N5CW device supporting 3GPP access shall refrain from allocating "PDU session identity value 15". If the TWIF acting on behalf of the N5CW device requests to establish a new PDU session, the TWIF acting on behalf of the N5CW device shall allocate the "PDU session identity value 15".

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

If the UE is registered for emergency services over the current access, the UE shall not request establishing a non-emergency PDU session over the current access. If the UE is registered for emergency services over the current access it shall not request establishing an emergency PDU session over the non-current access except if the request is for transferring the emergency PDU session to the non-current access. Before transferring an emergency PDU session from non-3GPP access to 3GPP access, or before transferring a PDN connection for emergency bearer services from untrusted non-3GPP access connected to EPC to 3GPP access, the UE shall check whether emergency services are supported in the NG-RAN cell (either an NR cell or an E-UTRA cell) on which the UE is camping.

NOTE 1: Transfer of an existing emergency PDU session or PDN connection for emergency bearer services between 3GPP access and non-3GPP access is needed e.g. if the UE determines that the current access is no longer available.

If the UE requests to establish a new emergency PDU session, the UE shall include the PDU session type IE in the PDU SESSION ESTABLISHMENT REQUEST message and shall set the IE to the IP version capability as specified in subclause 6.2.4.2.

If the UE requests to establish a new non-emergency PDU session with a DN, the UE shall include the PDU session type IE in the PDU SESSION ESTABLISHMENT REQUEST message and shall set the IE to one of the following values: "IPv4", "IPv6", "IPv4v6", "Ethernet" or "Unstructured" based on the URSP rules or based on UE local configuration (see 3GPP TS 24.526 [19]) and based on the IP version capability as specified in subclause 6.2.4.2.

NOTE 2: When the UE initiates the UE-requested PDU session establishment procedure to transfer an existing non-IP PDN connection in the EPS to the 5GS, the UE can use locally available information associated with the PDN connection to select the PDU session type between "Ethernet" and "Unstructured".

If the UE requests to establish a new non-emergency PDU session with a DN and the UE requests an SSC mode, the UE shall set the SSC mode IE of the PDU SESSION ESTABLISHMENT REQUEST message to the SSC mode. If the UE requests to establish a PDU session of "IPv4", "IPv6" or "IPv4v6" PDU session type, the UE shall either omit the SSC mode IE or set the SSC mode IE to "SSC mode 1", "SSC mode 2", or "SSC mode 3". If the UE requests to establish a PDU session of "Ethernet" or "Unstructured" PDU session type, the UE shall either omit the SSC mode IE or set the SSC mode IE to "SSC mode 1" or "SSC mode 2". If the UE requests transfer of an existing PDN connection in the EPS to the 5GS or the UE requests transfer of an existing PDN connection in an untrusted non-3GPP access connected to the EPC to the 5GS, the UE shall set the SSC mode IE to "SSC mode 1".

If the UE requests to establish a new emergency PDU session, the UE shall set the SSC mode IE of the PDU SESSION ESTABLISHMENT REQUEST message to "SSC mode 1".

A UE supporting PDU connectivity service shall support SSC mode 1 and may support SSC mode 2 and SSC mode 3 as specified in 3GPP TS 23.501 [8].

If the UE requests to establish a new non-emergency PDU session with a DN, the UE may include the SM PDU DN request container IE with a DN-specific identity of the UE complying with network access identifier (NAI) format as specified in IETF RFC 7542 [37].

NOTE 3: The UE can avoid including both the SM PDU DN request container IE and the Extended protocol configuration options IE with PAP/CHAP protocol identifiers in the PDU SESSION ESTABLISHMENT REQUEST message. The way to achieve this is implementation dependent.

If the UE requests to:

a) establish a new PDU session;

b) perform handover of an existing PDU session from non-3GPP access to 3GPP access;

c) transfer an existing PDN connection in the EPS to the 5GS according to subclause 4.8.2.3.1;

d) transfer an existing PDN connection in untrusted non-3GPP access connected to the EPC to the 5GS; or

e) establish user plane resources over 3GPP access of an MA PDU session established over non-3GPP access only;

and the UE at the same time intends to join one or more multicast MBS sessions that is associated to the PDU session, the UE should include the Requested MBS container IE in the PDU SESSION ESTABLISHMENT REQUEST message. In that case, the UE shall set the MBS operation to "Join multicast MBS session" and include the multicast MBS session information(s) and shall set the Type of multicast MBS session ID for each of the multicast MBS session information to either "Temporary Mobile Group Identity (TMGI)" or "Source specific IP multicast address" depending on the type of the multicast MBS session ID available in the UE. Then the remaining values of each of the multicast MBS session information shall be set as following:

a) if the Type of multicast MBS session ID is set to "Temporary Mobile Group Identity (TMGI)", the UE shall set the multicast MBS session ID to the TMGI; or

b) if the Type of multicast MBS session ID is set to "Source specific IP multicast address for IPv4" or " Source specific IP multicast address for IPv6", the UE shall set the Source IP address information and the Destination IP address information to the corresponding values.

The UE should not request to join a multicast MBS session for local MBS service if neither current TAI nor CGI of the current cell is part of the MBS service area(s) of the multicast MBS session, if the UE has valid information of the MBS service area(s) of the multicast MBS session.

NOTE 4: The UE obtains the details of the MBS session ID(s) e.g., TMGI, Source IP address information and Destination IP address information as a pre-configuration in the UE or during the MBS service announcement, which is out of scope of this specification. Pre-configuration can be provided in one or more of the following ways:

a) in a UE implementation-specific way (e.g. factory configuration);

b) in the USIM (see $EF_{5MBSUECONFIG}$ file in 3GPP TS 31.102 [22]); or

c) in the UE pre-configuration MO for MBS (see 3GPP TS 24.575 [65).

The UE should set the RQoS bit to "Reflective QoS supported" in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message if the UE supports reflective QoS and:

a) the UE requests to establish a new PDU session of "IPv4", "IPv6", "IPv4v6" or "Ethernet" PDU session type;

b) the UE requests to transfer an existing PDN connection in the EPS of "IPv4", "IPv6", "IPv4v6" or "Ethernet" PDN type or of "Non-IP" PDN type mapping to "Ethernet" PDU session type, to the 5GS; or

c) the UE requests to transfer an existing PDN connection in an untrusted non-3GPP access connected to the EPC of "IPv4", "IPv6" or "IPv4v6" PDN type to the 5GS.

NOTE 5: The determination to not request the usage of reflective QoS by the UE for a PDU session is implementation dependent.

The UE shall indicate the maximum number of packet filters that can be supported for the PDU session in the Maximum number of supported packet filters IE of the PDU SESSION ESTABLISHMENT REQUEST message if:

a) the UE requests to establish a new PDU session of "IPv4", "IPv6", "IPv4v6", or "Ethernet" PDU session type, and the UE can support more than 16 packet filters for this PDU session;

b) the UE requests to transfer an existing PDN connection in the EPS of "IPv4", "IPv6", "IPv4v6", or "Ethernet" PDN type or of "Non-IP" PDN type mapping to "Ethernet" PDU session type, to the 5GS and the UE can support more than 16 packet filters for this PDU session; or

c) the UE requests to transfer an existing PDN connection in an untrusted non-3GPP access connected to the EPC of "IPv4", "IPv6" or "IPv4v6" PDN type to the 5GS and the UE can support more than 16 packet filters for this PDU session.

The UE shall include the Integrity protection maximum data rate IE in the PDU SESSION ESTABLISHMENT REQUEST message to indicate the maximum data rate per UE for user-plane integrity protection supported by the UE for uplink and the maximum data rate per UE for user-plane integrity protection supported by the UE for downlink.

The UE shall set the MH6-PDU bit to "Multi-homed IPv6 PDU session supported" in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message if the UE supports multi-homed IPv6 PDU session and:

a) the UE requests to establish a new PDU session of "IPv6" or "IPv4v6" PDU session type; or.

b) the UE requests to transfer an existing PDN connection of "IPv6" or "IPv4v6" PDN type in the EPS or in an untrusted non-3GPP access connected to the EPC to the 5GS.

The UE shall set the EPT-S1 bit to "Ethernet PDN type in S1 mode supported" in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message if the UE supports Ethernet PDN type in S1 mode and requests "Ethernet" PDU session type.

If the UE requests to establish a new PDU session as an always-on PDU session (e.g. because the PDU session is for time synchronization or TSC), 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 ESTABLISHMENT REQUEST message.

NOTE 6: Determining whether a PDU session is for time synchronization or TSC is UE implementation dependent.

If the UE has an emergency PDU session, the UE shall not perform the UE-requested PDU session establishment procedure to establish another emergency PDU session. The UE may perform the UE-requested PDU session establishment procedure to transfer an existing emergency PDU session or an existing PDN connection for emergency services.

If:

a) the UE requests to perform handover of an existing PDU session between 3GPP access and non-3GPP access;

b) the UE requests to perform transfer an existing PDN connection in the EPS to the 5GS; or

c) the UE requests to perform transfer an existing PDN connection in an untrusted non-3GPP access connected to the EPC to the 5GS;

the UE shall:

a) set the PDU session ID in the PDU SESSION ESTABLISHMENT REQUEST message and in the UL NAS TRANSPORT message to the stored PDU session ID corresponding to the PDN connection; and

b) set the S-NSSAI in the UL NAS TRANSPORT message to the stored S-NSSAI associated with the PDU session ID of a non-emergency PDU session. The UE shall not request to perform handover of an existing non-emergency PDU session:

   1) between 3GPP access and non-3GPP access if the S-NSSAI is not included in the allowed NSSAI for the target access; or

   2) from non-3GPP access to 3GPP access:

      i) if the S-NSSAI is not in the partially allowed NSSAI for 3GPP access; or

      ii) if the S-NSSAI is in the partially allowed NSSAI for 3GPP access but the TAI where the UE is currently camped on is not in the list of TAs for which the S-NSSAI is supported.

If the N5CW device supporting 3GPP access requests to perform handover of an existing PDU session from non-3GPP access to 3GPP access, the N5CW device supporting 3GPP access shall set the PDU session ID in the PDU SESSION ESTABLISHMENT REQUEST message and in the UL NAS TRANSPORT message to "PDU session identity value 15".

If the UE is registered to a network which supports ATSSS and the UE requests to establish a new PDU session the UE may allow the network to upgrade the requested PDU session to an MA PDU session. In order to allow the network to upgrade the requested PDU session to an MA PDU session, the UE shall set "MA PDU session network upgrade is allowed" in the MA PDU session information IE and shall set the request type to "initial request" in the UL NAS TRANSPORT message. If the UE is registered to a network which does not support ATSSS, the UE shall not perform the procedure to allow the network to upgrade the requested PDU session to an MA PDU session.

If the UE is registered to a network which supports ATSSS, the UE may request to establish an MA PDU session. If the UE requests to establish an MA PDU session, the UE shall set the request type to "MA PDU request" in the UL NAS TRANSPORT message. If the UE is registered to a network which does not support ATSSS, the UE shall not request to establish an MA PDU session.

When the UE is registered over both 3GPP access and non-3GPP access in the same PLMN and the UE requests to establish a new MA PDU session, the UE may provide an S-NSSAI in the UL NAS TRANSPORT message only if the S-NSSAI is included in the allowed NSSAIs of both accesses.

NOTE 7: If the UE requested DNN corresponds to an LADN DNN, the AMF does not forward the MA PDU session information IE to the SMF but sends the message back to the UE to inform of the unhandled request (see subclause 5.4.5.2.5).

If the UE is registered to a network which supports ATSSS and the UE has already an MA PDU session established over one access, the UE may perform the UE-requested PDU session establishment procedure to establish user-plane resources over the other access for the MA PDU session as specified in subclause 4.22 of 3GPP TS 23.502 [9] and the S-NSSAI associated with the MA PDU session is included in the allowed NSSAI of the other access. If the UE establishes user-plane resources over the other access for the MA PDU session, the UE shall:

a) set the request type to "MA PDU request" in the UL NAS TRANSPORT message;

b) set the PDU session ID to the stored PDU session ID corresponding to the established MA PDU session in the PDU SESSION ESTABLISHMENT REQUEST message and in the UL NAS TRANSPORT message; and

c) set the S-NSSAI in the UL NAS TRANSPORT message to the stored S-NSSAI associated with the PDU session ID.

If the UE requests to establish a new MA PDU session or if the UE requests to establish a new PDU session and the UE allows the network to upgrade the requested PDU session to an MA PDU session, the UE shall:

a) set the ATSSS-ST bits in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message to indicate the ATSSS-LL and MPTCP functionalities, respectively, which the UE supports (see table 9.11.4.1.1) according to what is specified in subclause 5.32.6.1 of 3GPP TS 23.501 [8]; and

b) set the ATSSS-LL, MPTCP and MPQUIC-UDP bits in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message to indicate the ATSSS-LL, MPTCP and MPQUIC functionalities, respectively, which the UE supports (see table 9.11.4.1.1) according to what is specified in subclause 5.32.6.1 of 3GPP TS 23.501 [8];

NOTE 7A: Usage of the ATSSS-ST bits to indicate support for ATSSS functionality was deprecated in Rel-18 in favor of the ATSSS-LL, MPTCP and MPQUIC-UDP bits. The setting of the ATSSS-ST bits is necessary for backward compatibility with the earlier releases. The UE sets the ATSSS-ST bits in the same way as a UE from previous releases.

NOTE 8: The ATSSS Low-Layer functionality cannot be used together with the redundant steering mode. When the UE indicates that it is capable of supporting the ATSSS Low-Layer functionality with any steering mode, it implies that the UE supports the ATSSS Low-Layer functionality with any steering mode except the redundant steering mode.

c) void;

d) void;

e) void;

f) void;

g) void;

h) void.

If a performance measurement function in the UE can perform access performance measurements using the QoS flow of the non-default QoS rule as specified in subclause 5.32.5 of 3GPP TS 23.501 [8], the UE shall set the APMQF bit to "Access performance measurements per QoS flow supported" in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message.

Upon receipt of a PDU SESSION ESTABLISHMENT REQUEST message for MA PDU session establishment, the SMF shall check if the ATSSS-LL, MPTCP and MPQUIC-UDP bits (if set) or the ATSSS-ST bits (if none of the ATSSS-LL, MPTCP and MPQUIC-UDP bits, respectively, is set) in the PDU SESSION ESTABLISHMENT REQUEST message indicates:

NOTE 8A: If any of the ATSSS-LL, MPTCP and MPQUIC-UDP bits, respectively, is set then the SMF ignores the ATSSS-ST bits of the 5GSM capability IE.

a) support for any of the possible steering functionalities in addition to the ATSSS-LL functionality with only active-standby steering mode and:

   i) if the DNN configuration allows for the indicated steering functionality(ies) and the ATSSS-LL functionality with any steering mode (i.e., any steering mode allowed for ATSSS-LL functionality) but does not allow RTT measurement without using PMF protocol, the SMF shall ensure that the established PDU session has the capability of the indicated steering functionality(ies) and the ATSSS-LL with only active-standby steering mode, load balancing steering mode or priority based steering mode steering mode in the downlink and the indicated steering functionality(ies) and the ATSSS-LL with only active-standby steering mode in the uplink;

ii) if the DNN configuration allows for the the indicated steering functionality(ies) and the ATSSS-LL functionality with any steering mode (i.e., any steering mode allowed for ATSSS-LL functionality) and allows RTT measurement without using PMF protocol, the SMF shall ensure that the established PDU session has the capability of the indicated steering functionality(ies) and the ATSSS-LL with any steering mode (i.e., any steering mode allowed for ATSSS-LL functionality) in the downlink and the indicated steering functionality(ies) and the ATSSS-LL with only active-standby steering mode in the uplink; or

iii) if the DNN configuration allows for the indicated steering functionality(ies) and the ATSSS-LL functionality with only active-standby steering mode, the SMF shall ensure that the established PDU session has the capability of the indicated steering functionality(ies) and the ATSSS-LL with only active-standby steering mode in the downlink and the uplink;

b) support for ATSSS Low-Layer functionality with any steering mode allowed for ATSSS-LL and if the DNN configuration allows for the ATSSS-LL functionality with any steering mode (i.e., any steering mode allowed for ATSSS-LL functionality), the SMF shall ensure that the established PDU session has the capability of ATSSS-LL with any steering mode (i.e., any steering mode allowed for ATSSS-LL functionality) in the downlink and the uplink;

c) void;

d) void;

e) void;

f) void;

g) void;

h) support for any of the possible steering functionalities in addition to the ATSSS-LL functionality with any steering mode (i.e., any steering mode allowed for ATSSS-LL functionality) and if the DNN configuration does not allow for the indicated steering functionality and allows for the ATSSS-LL functionality with any steering mode (i.e., any steering mode allowed for ATSSS-LL functionality), the SMF shall ensure that the established PDU session has the capability of ATSSS-LL with any steering mode (i.e., any steering mode allowed for ATSSS-LL functionality) in the downlink and the uplink; or

i) support for any of the possible steering functionalities in addition to at least ATSSS-LL functionality with only active-standby steering mode and if the DNN configuration does not allow for the indicated steering functionality and allows at least for the ATSSS-LL functionality with only active-standby steering mode, the SMF shall ensure that the established PDU session has the capability of ATSSS-LL with only active-standby steering mode in the downlink and the uplink.

If the UE requests to establish a new MA PDU session and the UE supports to establish a PDN connection as the user plane resource of an MA PDU session, the UE shall include the ATSSS request parameter in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT REQUEST message.

If the UE is registered to a network which does not support ATSSS and the UE has already an MA PDU session established over one access, the UE shall not attempt to establish user-plane resources for the MA PDU session over the network which does not support ATSSS as specified in subclause 4.22 of 3GPP TS 23.502 [9].

If the UE supports 3GPP PS data off, except for the transfer of a PDU session from non-3GPP access to 3GPP access and except for the establishment of user plane resources on the other access for the MA PDU session, the UE shall include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT REQUEST message and include the 3GPP PS data off UE status. The UE behaves as described in subclause 6.2.10.

If the UE supports Reliable Data Service, the UE shall include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT REQUEST message and include the Reliable Data Service request indicator. The UE behaves as described in subclause 6.2.15.

If the UE supports DNS over (D)TLS (see 3GPP TS 33.501 [24]), the UE shall include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT REQUEST message and include DNS server security information indicator and optionally, if the UE wishes to indicate which security protocol type(s) are supported by the UE, it may include the DNS server security protocol support.

NOTE 9: Support of DNS over (D)TLS is based on the requirements as specified in 3GPP TS 33.501 [24].

If:

a) the PDU session type value of the PDU session type IE is set to "IPv4", "IPv6" or "IPv4v6";

b) the UE indicates "Control plane CIoT 5GS optimization supported" and "IP header compression for control plane CIoT 5GS optimization supported" in the 5GMM capability IE of the REGISTRATION REQUEST message; and

c) the network indicates "Control plane CIoT 5GS optimization supported" and "IP header compression for control plane CIoT 5GS optimization supported" in the 5GS network support feature IE of the REGISTRATION ACCEPT message;

the UE shall include the IP header compression configuration IE in the PDU SESSION ESTABLISHMENT REQUEST message.

If:

a) the PDU session type value of the PDU session type IE is set to "Ethernet";

b) the UE indicates "Control plane CIoT 5GS optimization supported" and "Ethernet header compression for control plane CIoT 5GS optimization supported" in the 5GMM capability IE of the REGISTRATION REQUEST message; and

c) the network indicates "Control plane CIoT 5GS optimization supported" and "Ethernet header compression for control plane CIoT 5GS optimization supported" in the 5GS network support feature IE of the REGISTRATION ACCEPT message;

the UE shall include the Ethernet header compression configuration IE in the PDU SESSION ESTABLISHMENT REQUEST message.

If the UE supports transfer of port management information containers, the UE shall:

a) set the TPMIC bit to "Transfer of port management information containers supported" in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message;

b) if the UE requests to establish a PDU session of "Ethernet" PDU session type, include the DS-TT Ethernet port MAC address IE in the PDU SESSION ESTABLISHMENT REQUEST message and set its contents to the MAC address of the DS-TT Ethernet port used for the PDU session;

c) if the UE-DS-TT residence time is available at the UE, include the UE-DS-TT residence time IE and set its contents to the UE-DS-TT residence time; and

d) if a Port management information container is provided by the DS-TT, include the Port management information container IE in the PDU SESSION ESTABLISHMENT REQUEST message.

NOTE 10: Only SSC mode 1 is supported for a PDU session which is for time synchronization or TSC.

If the UE supports secondary DN authentication and authorization over EPC, the UE shall set the SDNAEPC bit to "Secondary DN authentication and authorization over EPC supported" in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message.

If the UE supporting S1 mode supports receiving QoS rules with the length of two octets or QoS flow descriptions with the length of two octets via the Extended protocol configuration options IE, the UE shall include the QoS rules with the length of two octets support indicator or the QoS flow descriptions with the length of two octets support indicator, respectively, in the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT REQUEST message.

If the UE supports URSP provisioning in EPS, the UE shall include the URSP provisioning in EPS support indicator in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT REQUEST message.

If:

- the UE is operating in single-registration mode;

- the UE supports local IP address in traffic flow aggregate description and TFT filter in S1 mode; and

- the PDU session Type requested is different from "Unstructured".

the UE shall indicate the support of local address in TFT in S1 mode in the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT REQUEST message.

If the W-AGF acting on behalf of the FN-RG requests to establish a PDU session of "IPv6" or "IPv4v6" PDU session type, the W-AGF acting on behalf of the FN-RG may include in the PDU SESSION ESTABLISHMENT REQUEST message the Suggested interface identifier IE with the PDU session type value field set to "IPv6" and containing the interface identifier for the IPv6 link local address associated with the PDU session suggested to be allocated to the FN-RG.

If the UE supports provisioning of ECS configuration information to the EEC in the UE, then the UE shall include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT REQUEST message and shall include the ECS configuration information provisioning support indicator.

If the UE supports receiving DNS server addresses in protocol configuration options, the UE shall include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT REQUEST message and in the Extended protocol configuration options IE:

a) if the UE requests to establish a PDU session of "IPv4" or "IPv4v6" PDU session type, the UE shall include the DNS server IPv4 address request; and

b) if the UE requests to establish a PDU session of "IPv6" or "IPv4v6" PDU session type, the UE shall include the DNS server IPv6 address request.

If the UE supporting UAS services requests to establish a PDU session for C2 communication, the UE shall include the Service-level-AA container IE in the PDU SESSION ESTABLISHMENT REQUEST message. In the Service-level-AA container IE, the UE shall include:

a) the service-level device ID with the value set to the CAA-level UAV ID of the UE; and

b) if available, the service-level-AA payload with the value set to the C2 authorization payload and the service-level-AA payload type with the value set to "C2 authorization payload".

NOTE 11: The C2 authorization payload in the service-level-AA payload can include one, some or all of the pairing information for C2 communication, an indication of the request for direct C2 communication, pairing information for direct C2 communication, and the UAV flight authorization information.

If the UE supports the EAS rediscovery, the UE shall include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT REQUEST message and shall include the EAS rediscovery support indication in the Extended protocol configuration options IE.

If the UE needs to include a PDU session pair ID based on the matching URSP rule or UE local configuration, the UE shall include the PDU session pair ID IE in the PDU SESSION ESTABLISHMENT REQUEST message. If the UE needs to include an RSN based on the matching URSP rule or UE local configuration, the UE shall include the RSN IE in the PDU SESSION ESTABLISHMENT REQUEST message.

If the UE is not registered for onboarding services in SNPN and needs PVS information, the UE shall include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT REQUEST message and include the PVS information request in the Extended protocol configuration options IE.

If the UE supports the EDC, the UE shall include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT REQUEST message and shall include the EDC support indicator in the Extended protocol configuration options IE.

If the UE supports a "destination MAC address range type" packet filter component and a "source MAC address range type" packet filter component, the UE shall include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT REQUEST message and shall include the MS support of MAC address range in 5GS indicator in the Extended protocol configuration options IE.

If the UE supports reporting of URSP rule enforcement and is indicated to send URSP rule enforcement report to network based on the matching URSP rule which contains the URSP rule enforcement report indication set to "URSP rule enforcement report is required", the UE shall include the URSP rule enforcement reports IE in the PDU SESSION ESTABLISHMENT REQUEST message.

The UE shall transport:

a) the PDU SESSION ESTABLISHMENT REQUEST message;

b) the PDU session ID of the PDU session being established, being handed over, being transferred, or been established as an MA PDU session;

c) if the request type is set to:

1) "initial request" or "MA PDU request" and the UE determined to establish a new PDU session or an MA PDU session based on either a URSP rule including one or more S-NSSAIs in the URSP (see subclause 6.2.9) or UE local configuration, according to subclause 4.2.2 of 3GPP TS 24.526 [19]:

i) if the UE is in the HPLMN or the subscribed SNPN, an S-NSSAI in the allowed NSSAI which corresponds to one of the S-NSSAI(s) in the matching URSP rule, if any, or else to the S-NSSAI(s) in the UE local configuration or in the default URSP rule, if any, according to the conditions given in subclause 4.2.2 of 3GPP TS 24.526 [19];

ii) if the UE is in a non-subscribed SNPN, the UE determined according to the conditions given in subclause 4.2.2 of 3GPP TS 24.526 [19] to establish a new PDU session or an MA PDU session based on a URSP rule including one or more S-NSSAIs, and the URSP rule is a part of a non-subscribed SNPN signalled URSP (see 3GPP TS 24.526 [19]):

A) an S-NSSAI in the allowed NSSAI, which is one of the S-NSSAI(s) in the URSP rule; and

B) a mapped S-NSSAI associated with the S-NSSAI in A); or

iii) otherwise:

A) one of the mapped S-NSSAI(s) which is equal to one of the S-NSSAI(s) in the matching URSP rule, if any, or else to the S-NSSAI(s) in the UE local configuration or in the default URSP rule, if any, according to the conditions given in subclause 4.2.2 of 3GPP TS 24.526 [19]; and

B) the S-NSSAI in the allowed NSSAI associated with the S-NSSAI in A); or

1a) "initial request" and the UE determined to establish a new PDU session based on the PDU session parameters for 5G ProSe layer-3 UE-to-network relay UE including an S-NSSAI in the UE policies for 5G ProSe UE-to-network relay UE as defined in 3GPP TS 24.555 [19F]:

i) in case of a non-roaming scenario, an S-NSSAI in the allowed NSSAI which corresponds to the S-NSSAI in the selected PDU session parameters for 5G ProSe layer-3 UE-to-network relay UE, if any; or

ii) in case of a roaming scenario:

A) one of the mapped S-NSSAI(s) which corresponds to the S-NSSAI in the selected PDU session parameters for 5G ProSe layer-3 UE-to-network relay UE, if any; and

B) the S-NSSAI in the allowed NSSAI associated with the S-NSSAI in A);

NOTE 12: When the UE is roaming, an AMF compliant with earlier versions of the specification can omit providing to the UE a mapped S-NSSAI for one or more S-NSSAIs in the allowed NSSAI and the UE then locally sets the mapped S-NSSAI as described in subclause 4.6.2.1.

1b) "initial request" and the UE has the partially allowed NSSAI and determined to establish a new PDU session based on either a URSP rule including one or more S-NSSAIs in the URSP (see subclause 6.2.9) or UE local configuration, according to subclause 4.2.2 of 3GPP TS 24.526 [19]:

i) if the UE is in the HPLMN or the subscribed SNPN and the current TA is in the list of TAs for which the S-NSSAI is allowed, an S-NSSAI in the partially allowed NSSAI which corresponds to one of the S-NSSAI(s) in the matching URSP rule, if any, or else to the S-NSSAI(s) in the UE local configuration or in the default URSP rule, if any, according to the conditions given in subclause 4.2.2 of 3GPP TS 24.526 [19];

ii) if the UE is in the VPLMN or a non-subscribed SNPN, the UE determined according to the conditions given in subclause 4.2.2 of 3GPP TS 24.526 [19] to establish a new PDU session based on a URSP rule

including one or more S-NSSAIs, the URSP rule is a part of a non-subscribed SNPN signalled URSP (see 3GPP TS 24.526 [19]) and the current TA is in the list of TAs for which the S-NSSAI is allowed:

A) an S-NSSAI in the partially allowed NSSAI, which is one of the S-NSSAI(s) in the URSP rule; and

B) a mapped S-NSSAI associated with the S-NSSAI in A); or

2) "existing PDU session", an S-NSSAI, which is an S-NSSAI in the allowed NSSAI associated with the PDU session and (in roaming scenarios) a mapped S-NSSAI, with exception when S-NSSAI is not provided by the network in subclause 6.1.4.2;

c1) the alternative S-NSSAI associated with the S-NSSAI to be replaced, if an alternative S-NSSAI for the S-NSSAI or the mapped S-NSSAI exists;

d) if the request type is set to:

1) "initial request" or "MA PDU request" and the UE determined to establish a new PDU session or an MA PDU session based on either a URSP rule including one or more DNNs in the URSP (see subclause 6.2.9) or UE local configuration, according to subclause 4.2.2 of 3GPP TS 24.526 [19], a DNN which corresponds to one of the DNN(s) in the matching URSP rule, if any, or else to the DNN(s) in the UE local configuration or in the default URSP rule, if any, according to the conditions given in subclause 4.2.2 of 3GPP TS 24.526 [19];

1a) "initial request" and the UE determined to establish a new PDU session based on the PDU session parameters for 5G ProSe layer-3 UE-to-network relay UE including a DNN in the UE policies for 5G ProSe UE-to-network relay UE as defined in 3GPP TS 24.555 [19F], a DNN which corresponds to the DNN in the selected PDU session parameters for 5G ProSe layer-3 UE-to-network relay UE, if any; or

2) "existing PDU session", a DNN which is a DNN associated with the PDU session;

e) the request type which is set to:

1) "initial request", if the UE is not registered for emergency services and the UE requests to establish a new non-emergency PDU session;

2) "existing PDU session", if the UE is not registered for emergency services and the UE requests:

i) handover of an existing non-emergency PDU session between 3GPP access and non-3GPP access;

ii) transfer of an existing PDN connection for non-emergency bearer services in the EPS to the 5GS; or

iii) transfer of an existing PDN connection for non-emergency bearer services in an untrusted non-3GPP access connected to the EPC to the 5GS;

3) "initial emergency request", if the UE requests to establish a new emergency PDU session;

4) "existing emergency PDU session", if the UE requests:

i) handover of an existing emergency PDU session between 3GPP access and non-3GPP access;

ii) transfer of an existing PDN connection for emergency bearer services in the EPS to the 5GS; or

iii) transfer of an existing PDN connection for emergency bearer services in an untrusted non-3GPP access connected to the EPC to the 5GS; or

5) "MA PDU request", if:

i) the UE requests to establish an MA PDU session;

ii) the UE requests to establish user plane resources over other access of an MA PDU session established over one access only; or

iii) the UE performs inter-system change from S1 mode to N1 mode according to subclause 4.8.2.3.1 and requests transfer of a PDN connection which is a user plane resource of an MA PDU session; and

f) the old PDU session ID which is the PDU session ID of the existing PDU session, if the UE initiates the UE-requested PDU session establishment procedure upon receiving the PDU SESSION MODIFICATION COMMAND messages with the 5GSM cause IE set to #39 "reactivation requested";

NOTE 13: If the PDU SESSION MODIFICATION COMMAND message included alternative S-NSSAI, the UE includes alternative S-NSSAI in the PDU SESSION ESTABLISHMENT REQUEST message for PDU session re-establishment.

using the NAS transport procedure as specified in subclause 5.4.5, and the UE shall start timer T3580 (see example in figure 6.4.1.2.1).

For bullet c) 1), if the matching URSP rule does not have an associated S-NSSAI, or if the UE does not have any matching URSP rule and there is no S-NSSAI in the UE local configuration or in the default URSP rule, the UE shall not provide any S-NSSAI in a PDU session establishment procedure.

For bullet c) 1a), if the selected PDU session parameters for 5G ProSe layer-3 UE-to-network relay UE do not have an associated S-NSSAI, the UE shall not provide any S-NSSAI in a PDU session establishment procedure.

For bullet d) 1),

- If the matching non-default URSP rule does not have an associated DNN, then the UE shall not provide any DNN in a PDU session establishment procedure;

- If the UE does not have any matching non-default URSP rule, the UE requests a connectivity that requires PAP/CHAP and the UE is configured with the default DNN for the S-NSSAI in the UE local configuration corresponding to the request, then the UE should provide such DNN in a PDU session establishment procedure;

- If the UE does not have any matching non-default URSP rule, the UE requests a connectivity that requires PAP/CHAP, the UE is not configured with the default DNN for the S-NSSAI in the UE local configuration corresponding to the request, and the application provides the DNN, then the UE shall use such DNN in a PDU session establishment procedure;

- If the UE does not have any matching non-default URSP rule, the UE requests a connectivity that does not require PAP/CHAP, the UE is not configured with the DNN for the S-NSSAI in the UE local configuration corresponding to the request, and the application provides the DNN, then the UE shall use such DNN in a PDU session establishment procedure;

- If the UE does not have any matching non-default URSP rule, the UE requests a connectivity that requires PAP/CHAP, the UE is not configured with the default DNN for the S-NSSAI in the UE local configuration corresponding to the request, the application does not provide the DNN and there is no DNN in the default URSP rule, then the UE shall not provide any DNN in a PDU session establishment procedure; or

- If the UE does not have any matching non-default URSP rule, the UE requests a connectivity that does not require PAP/CHAP, the UE is not configured with the DNN for the S-NSSAI in the UE local configuration corresponding to the request, the application does not provide the DNN and there is no DNN in the default URSP rule, then the UE shall not provide any DNN in a PDU session establishment procedure.

For bullet d) 1a), if the selected the PDU session parameters for 5G ProSe layer-3 UE-to-network relay UE do not have an associated DNN, the UE shall not provide any DNN in a PDU session establishment procedure.

If the request type is set to "initial emergency request" or "existing emergency PDU session" or the UE is registered for onboarding services in SNPN, neither DNN nor S-NSSAI is transported by the UE using the NAS transport procedure as specified in subclause 5.4.5.

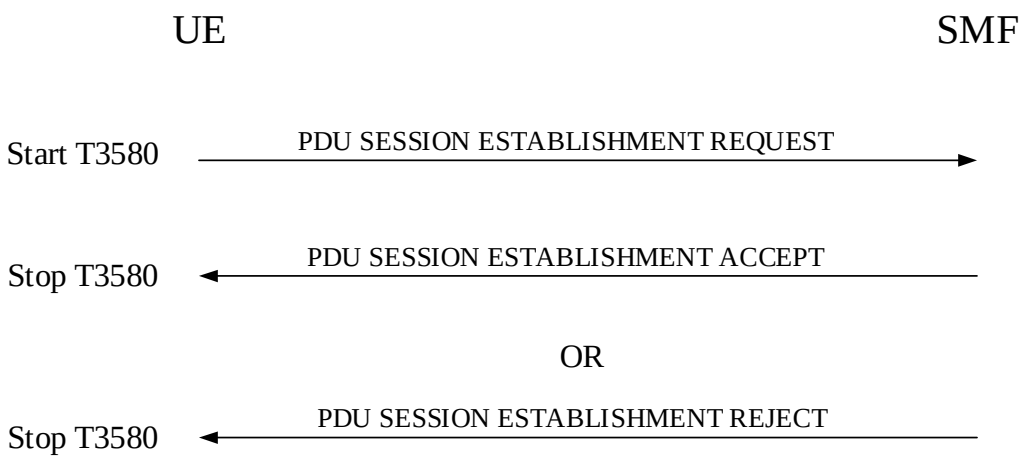


Figure 6.4.1.2.1: UE-requested PDU session establishment procedure

Upon receipt of a PDU SESSION ESTABLISHMENT REQUEST message, a PDU session ID, optionally an S-NSSAI associated with (in roaming scenarios) a mapped S-NSSAI, optionally a DNN determined by the AMF, optionally a DNN selected by the network (if different from the DNN determined by the AMF), the request type, and optionally an old PDU session ID, the SMF checks whether connectivity with the requested DN can be established. If the requested DNN is not included, the SMF shall use the default DNN.

If the PDU session being established is a non-emergency PDU session, the request type is not set to "existing PDU session" and the PDU session authentication and authorization by the external DN is required due to local policy, the SMF shall check whether the PDU SESSION ESTABLISHMENT REQUEST message includes the SM PDU DN request container IE or the Service-level-AA container IE.

If the PDU session being established is a non-emergency PDU session, the request type is not set to "existing PDU session", the SM PDU DN request container IE is included in the PDU SESSION ESTABLISHMENT REQUEST message, the PDU session authentication and authorization by the external DN is required due to local policy and user's subscription data, and:

a) the information for the PDU session authentication and authorization by the external DN in the SM PDU DN request container IE is compliant with the local policy and user's subscription data, the SMF shall proceed with the EAP Authentication procedure specified in 3GPP TS 33.501 [24] and refrain from accepting or rejecting the PDU SESSION ESTABLISHMENT REQUEST message until the EAP Authentication procedure finalizes; or

b) the information for the PDU session authentication and authorization by the external DN in the SM PDU DN request container IE is not compliant with the local policy and user's subscription data, the SMF shall consider it as an abnormal case and proceed as specified in subclause 6.4.1.7.

If the PDU session being established is a non-emergency PDU session, the request type is not set to "existing PDU session", the SM PDU DN request container IE is not included in the PDU SESSION ESTABLISHMENT REQUEST message and the PDU session authentication and authorization by the external DN is required due to local policy and user's subscription data, the SMF shall proceed with the EAP Authentication procedure specified in 3GPP TS 33.501 [24] and refrain from accepting or rejecting the PDU SESSION ESTABLISHMENT REQUEST message until the EAP Authentication procedure finalizes.

If the SMF receives the old PDU session ID from the AMF and a PDU session exists for the old PDU session ID, the SMF shall consider that the request for the relocation of SSC mode 3 PDU session anchor with multiple PDU sessions as specified in 3GPP TS 23.502 [9] is accepted by the UE.

If the SMF receives the onboarding indication from the AMF, the SMF shall consider that the PDU session is established for onboarding services in SNPN.

If the UE has set the TPMIC bit to "Transfer of port management information containers supported" in the 5GSM capability IE of the PDU SESSION ESTABLISHMENT REQUEST message and has included a DS-TT Ethernet port MAC address IE (if the PDU session type is "Ethernet"), the Port management information container IE, and,

optionally, the UE-DS-TT residence time IE in the PDU SESSION ESTABLISHMENT REQUEST message, the SMF shall operate as specified in 3GPP TS 23.502 [9] subclause 4.3.2.2.1.

If requested by the upper layers, the UE supporting UAS services shall initiate a request to establish a PDU session for UAS services, where the UE:

a) shall include the service-level device ID with the value set to the CAA-level UAV ID;

b) if provided by the upper layers, shall include the service-level-AA server address, with the value set to the USS address; and

c) if provided by the upper layers, shall include:

   i) the service-level-AA payload type, with the value set to "UUAA payload"; and

   ii) the service-level-AA payload, with the value set to UUAA payload,

in the Service-level-AA container IE of the PDU SESSION ESTABLISHMENT REQUEST message.

If the PDU session being established is a non-emergency PDU session, the request type is not set to "existing PDU session", the Service-level-AA container IE is included in the PDU SESSION ESTABLISHMENT REQUEST message, and

a) the service-level authentication and authorization by the external DN is required due to local policy;

b) there is a valid user's subscription information for the requested DNN or for the requested DNN and S-NSSAI; and

c) the information for the service-level authentication and authorization by the external DN in the Service-level-AA container IE includes CAA-level UAV ID,

then the SMF shall proceed with the UUAA-SM procedure as specified in 3GPP TS 23.256 [6AB] and refrain from accepting or rejecting the PDU SESSION ESTABLISHMENT REQUEST message until the service-level authentication and authorization procedure is completed.

The UE supporting UAS services shall not request a PDU session establishment procedure to the same DNN (or no DNN, if no DNN was indicated by the UE) and the same S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE) for which the UE has requested a service level authentication and authorization procedure which is ongoing.

If the PDU SESSION ESTABLISHMENT REQUEST message includes the PDU session pair ID IE, the RSN IE, or both, the SMF shall operate as specified in subclause 5.33.2 of 3GPP TS 23.501 [8].

6.4.1.3 UE-requested PDU session establishment procedure accepted by the network

If the connectivity with the requested DN is accepted by the network, the SMF shall create a PDU SESSION ESTABLISHMENT ACCEPT message.

If the UE requests establishing an emergency PDU session, the network shall not check for service area restrictions or subscription restrictions when processing the PDU SESSION ESTABLISHMENT REQUEST message.

The SMF shall set the Authorized QoS rules IE of the PDU SESSION ESTABLISHMENT ACCEPT message to the authorized QoS rules of the PDU session and may include the authorized QoS flow descriptions IE of the PDU SESSION ESTABLISHMENT ACCEPT message set to the authorized QoS flow descriptions of the PDU session.

NOTE 1: This is applicable also if the PDU session establishment procedure was initiated to perform handover of an existing PDU session between 3GPP access and non-3GPP access, and even if the authorized QoS rules and authorized QoS flow descriptions for source and target access of the handover are the same.

The SMF shall ensure that the number of the packet filters used in the authorized QoS rules of the PDU Session does not exceed the maximum number of packet filters supported by the UE for the PDU session. If the received request type is "initial emergency request", the SMF shall set the Authorized QoS flow descriptions IE according to the QoS parameters used for establishing emergency services as specified in subclause 5.16.4 of 3GPP TS 23.501 [8].

SMF shall set the Authorized QoS flow descriptions IE to the authorized QoS flow descriptions of the PDU session, if:

a) the Authorized QoS rules IE contains at least one GBR QoS flow;

b) the QFI is not the same as the 5QI of the QoS flow identified by the QFI;

c) the QoS flow can be mapped to an EPS bearer as specified in subclause 4.11.1 of 3GPP TS 23.502 [9]; or

d) the QoS flow is established for the PDU session used for relaying, as specified in subclause 5.6.2.1 of 3GPP TS 23.304 [6E].

NOTE 2: In cases other than above listed cases, it is up to the SMF implementation to include the authorized QoS flow description for the QoS flow in the Authorized QoS flow descriptions IE of the PDU SESSION ESTABLISHMENT ACCEPT message.

If interworking with EPS is supported for the PDU session, the SMF shall set in the PDU SESSION ESTABLISHMENT ACCEPT message:

a) the Mapped EPS bearer contexts IE to the EPS bearer contexts mapped from one or more QoS flows of the PDU session; and

b) the EPS bearer identity parameter in the Authorized QoS flow descriptions IE to the EPS bearer identity corresponding to the QoS flow, for each QoS flow which can be transferred to EPS.

If the "Create new EPS bearer" operation code in the Mapped EPS bearer contexts IE was received, and there is no corresponding Authorized QoS flow descriptions IE in the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall send a PDU SESSION MODIFICATION REQUEST message including a Mapped EPS bearer contexts IE to delete the mapped EPS bearer context. If the EPS bearer identity parameter in the Authorized QoS flow descriptions IE was received, the operation code is "Create new QoS flow description" and there is no corresponding Mapped EPS bearer contexts IE in the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall not diagnose an error, and shall keep storing the association between the QoS flow and the corresponding EPS bearer identity.

Furthermore, the SMF shall store the association between the QoS flow and the mapped EPS bearer context, for each QoS flow which can be transferred to EPS.

The SMF shall set the selected SSC mode IE of the PDU SESSION ESTABLISHMENT ACCEPT message to:

a) the received SSC mode in the SSC mode IE included in the PDU SESSION ESTABLISHMENT REQUEST message based on one or more of the PDU session type, the subscription and the SMF configuration;

b) either the default SSC mode for the data network listed in the subscription or the SSC mode associated with the SMF configuration, if the SSC mode IE is not included in the PDU SESSION ESTABLISHMENT REQUEST message.

NOTE 3: For bullet b), to avoid issues for UEs not supporting all SSC modes, the network operator can, in the subscription data and local configuration, include at least SSC mode 1 in the allowed SSC modes, and set the default SSC mode to "SSC mode 1" as per 3GPP TS 23.501 [8].

If the PDU session is an emergency PDU session, the SMF shall set the Selected SSC mode IE of the PDU SESSION ESTABLISHMENT ACCEPT message to "SSC mode 1". If the PDU session is a non-emergency PDU session of "Ethernet" or "Unstructured" PDU session type, the SMF shall set the Selected SSC mode IE to "SSC mode 1" or "SSC mode 2". If the PDU session is a non-emergency PDU session of "IPv4", "IPv6" or "IPv4v6" PDU session type, the SMF shall set the selected SSC mode IE to "SSC mode 1", "SSC mode 2", or "SSC mode 3".

If the PDU session is a non-emergency PDU session and the UE is not registered for onboarding services in SNPN, the SMF shall set the S-NSSAI IE of the PDU SESSION ESTABLISHMENT ACCEPT message to:

a) the S-NSSAI of the PDU session; and

b) the mapped S-NSSAI (in roaming scenarios).

The S-NSSAI or the mapped S-NSSAI (in roaming scenarios) of the PDU session shall be the alternative S-NSSAI if the SMF has received an alternative S-NSSAI from the AMF.

The SMF shall set the Selected PDU session type IE of the PDU SESSION ESTABLISHMENT ACCEPT message to the selected PDU session type, i.e. the PDU session type of the PDU session.

If the PDU SESSION ESTABLISHMENT REQUEST message includes a PDU session type IE set to "IPv4v6", the SMF shall select "IPv4", "IPv6" or "IPv4v6" as the Selected PDU session type. If the subscription, the SMF configuration, or both, are limited to IPv4 only or IPv6 only for the DNN selected by the network, the SMF shall include the 5GSM cause value #50 "PDU session type IPv4 only allowed", or #51 "PDU session type IPv6 only allowed", respectively, in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT ACCEPT message.

If the selected PDU session type is "IPv4", the SMF shall include the PDU address IE in the PDU SESSION ESTABLISHMENT ACCEPT message and shall set the PDU address IE to an IPv4 address is allocated to the UE in the PDU session.

If the selected PDU session type is "IPv6", the SMF shall include the PDU address IE in the PDU SESSION ESTABLISHMENT ACCEPT message and shall set the PDU address IE to an interface identifier for the IPv6 link local address allocated to the UE in the PDU session.

If the selected PDU session type is "IPv4v6", the SMF shall include the PDU address IE in the PDU SESSION ESTABLISHMENT ACCEPT message and shall set the PDU address IE to an IPv4 address and an interface identifier for the IPv6 link local address, allocated to the UE in the PDU session.

If the selected PDU session type of a PDU session established by the W-AGF acting on behalf of the FN-RG is "IPv4v6" or "IPv6", the SMF shall also indicate the SMF's IPv6 link local address in the PDU address IE of the PDU SESSION ESTABLISHMENT ACCEPT message.

If the PDU session is a non-emergency PDU session and the UE is not registered for onboarding services in SNPN, the SMF shall set the DNN IE of the PDU SESSION ESTABLISHMENT ACCEPT message to the DNN determined by the AMF of the PDU session.

The SMF shall set the Session-AMBR IE of the PDU SESSION ESTABLISHMENT ACCEPT message to the Session-AMBR of the PDU session.

If the selected PDU session type is "IPv4", "IPv6", "IPv4v6" or "Ethernet" and if the PDU SESSION ESTABLISHMENT REQUEST message includes a 5GSM capability IE with the RQoS bit set to "Reflective QoS supported", the SMF shall consider that reflective QoS is supported for QoS flows belonging to this PDU session and may include the RQ timer IE set to an RQ timer value in the PDU SESSION ESTABLISHMENT ACCEPT message.

If the selected PDU session type is "IPv4", "IPv6", "IPv4v6" or "Ethernet" and if the PDU SESSION ESTABLISHMENT REQUEST message includes a Maximum number of supported packet filters IE, the SMF shall consider this number as the maximum number of packet filters that can be supported by the UE for this PDU session. Otherwise the SMF considers that the UE supports 16 packet filters for this PDU session.

The SMF shall consider that the maximum data rate per UE for user-plane integrity protection supported by the UE for uplink and the maximum data rate per UE for user-plane integrity protection supported by the UE for downlink are valid for the lifetime of the PDU session.

If the value of the RQ timer is set to "deactivated" or has a value of zero, the UE considers that RQoS is not applied for this PDU session.

NOTE 4: If the 5G core network determines that reflective QoS is to be used for a QoS flow, the SMF sends reflective QoS indication (RQI) to UPF to activate reflective QoS. If the QoS flow is established over 3GPP access, the SMF also includes reflective QoS Attribute (RQA) in QoS profile of the QoS flow during QoS flow establishment.

If the selected PDU session type is "IPv6" or "IPv4v6" and if the PDU SESSION ESTABLISHMENT REQUEST message includes a 5GSM capability IE with the MH6-PDU bit set to "Multi-homed IPv6 PDU session supported", the SMF shall consider that this PDU session is supported to use multiple IPv6 prefixes.

If the selected PDU session type is "Ethernet", the PDU SESSION ESTABLISHMENT REQUEST message includes a 5GSM capability IE with the EPT-S1 bit set to "Ethernet PDN type in S1 mode supported" and the network supports Ethernet PDN type in S1 mode, the SMF shall set the EPT-S1 bit of the 5GSM network feature support IE of the PDU SESSION ESTABLISHMENT ACCEPT message to "Ethernet PDN type in S1 mode supported".

If the AMF has indicated to the SMF that the UE supports the non-3GPP access path switching and the SMF supports the non-3GPP access path switching, the SMF shall set the NAPS bit of the 5GSM network feature support IE of the PDU SESSION ESTABLISHMENT ACCEPT message to "non-3GPP access path switching supported".

If the DN authentication of the UE was performed and completed successfully, the SMF shall set the EAP message IE of the PDU SESSION ESTABLISHMENT ACCEPT message to an EAP-success message as specified in IETF RFC 3748 [34], provided by the DN.

Based on local policies or configurations in the SMF and the Always-on PDU session requested IE in the PDU SESSION ESTABLISHMENT REQUEST message (if available), if the SMF determines that either:

a) the requested PDU session needs to be established as an always-on PDU session (e.g. because the PDU session is for time synchronization or TSC, for URLLC, or for both), the SMF shall include the Always-on PDU session indication IE in the PDU SESSION ESTABLISHMENT ACCEPT message and shall set the value to "Always-on PDU session required"; or

b) the requested PDU session shall not be established as an always-on PDU session and:

   i) if the UE included the Always-on PDU session requested IE, the SMF shall include the Always-on PDU session indication IE in the PDU SESSION ESTABLISHMENT ACCEPT message and shall set the value to "Always-on PDU session not allowed"; or

   ii) if the UE did not include the Always-on PDU session requested IE, the SMF shall not include the Always-on PDU session indication IE in the PDU SESSION ESTABLISHMENT ACCEPT message.

If the PDU session is an MA PDU session, the SMF shall include the ATSSS container IE in the PDU SESSION ESTABLISHMENT ACCEPT message. The SMF shall set the content of the ATSSS container IE as specified in 3GPP TS 24.193 [13B]. If the UE requests to establish user plane resources over the second access of an MA PDU session which has already been established over the first access and the parameters associated with ATSSS previously provided to the UE are not to be updated, the "ATSSS container contents" shall not be included in the ATSSS container IE in the PDU SESSION ESTABLISHMENT ACCEPT message.

If the PDU session is a single access PDU session containing the MA PDU session information IE with the value set to "MA PDU session network upgrade is allowed" and:

a) if the SMF decides to establish a single access PDU session, the SMF shall not include the ATSSS container IE in the PDU SESSION ESTABLISHMENT ACCEPT message; or

b) if the SMF decides to establish an MA PDU session, the SMF shall include the ATSSS container IE in the PDU SESSION ESTABLISHMENT ACCEPT message, which indicates to the UE that the requested single access PDU session was established as an MA PDU Session.

If the network decides that the PDU session is only for control plane CIoT 5GS optimization, the SMF shall include the control plane only indication in the PDU SESSION ESTABLISHMENT ACCEPT message.

If:

a) the UE provided the IP header compression configuration IE in the PDU SESSION ESTABLISHMENT REQUEST message; and

b) the SMF supports IP header compression for control plane CIoT 5GS optimization;

the SMF shall include the IP header compression configuration IE in the PDU SESSION ESTABLISHMENT ACCEPT message.

If:

a) the UE provided the Ethernet header compression configuration IE in the PDU SESSION ESTABLISHMENT REQUEST message; and

b) the SMF supports Ethernet header compression for control plane CIoT 5GS optimization;

the SMF shall include the Ethernet header compression configuration IE in the PDU SESSION ESTABLISHMENT ACCEPT message.

If the PDU SESSION ESTABLISHMENT REQUEST included the Requested MBS container IE with the MBS operation set to "Join MBS session", the SMF:

a) shall include the TMGI for the multicast MBS session IDs that the UE is allowed to join, if any, in the Received MBS container IE, shall set the MBS decision to "MBS join is accepted" for each of those Received MBS

information, may include the MBS start time to indicate the time when the multicast MBS session starts and shall include the MBS security container in each of those Received MBS information if security protection is applied for that multicast MBS session and the control plane security procedure is used as specified in annex W.4.1.2 in 3GPP TS 33.501 [24], and shall use separate QoS flows dedicated for multicast by including the Authorized QoS flow descriptions IE if no separate QoS flows dedicated for multicast exist or if the SMF wants to establish new QoS flows dedicated for multicast;

NOTE 5: The network determines whether security protection applies or not for the multicast MBS session as specified in 3GPP TS 33.501 [24].

b) shall include the TMGI for multicast MBS session IDs that the UE is not allowed to join, if any, in the Received MBS container IE, shall set the MBS decision to "MBS join is rejected" for each of those Received MBS information, shall set the Rejection cause for each of those Received MBS information with the reason of rejection, and if the Rejection cause is set to "multicast MBS session has not started or will not start soon", may include an MBS back-off timer value; and

c) may include in the Received MBS container IE the MBS service area for each multicast MBS session and include in it the MBS TAI list, the NR CGI list or both, that identify the service area(s) for the local MBS service

NOTE 6: For an multicast MBS session that has multiple MBS service areas, the MBS service areas are indicated to the UE using MBS service announcement as described in 3GPP TS 23.247 [53], which is out of scope of this specification.

in the PDU SESSION ESTABLISHMENT ACCEPT message. If the UE has set the Type of multicast MBS session ID to "Source specific IP multicast address" in the Requested multicast MBS container IE for certain MBS session(s) in the PDU SESSION ESTABLISHMENT REQUEST message, the SMF shall include the Source IP address information and Destination IP address information in the Received MBS information together with the TMGI for each of those multicast MBS sessions.

NOTE 7: Including the Source IP address information and Destination IP address information in the Received MBS information in that case is to allow the UE to perform the mapping between the requested multicast MBS session ID and the provided TMGI.

NOTE 8: In SNPN, TMGI is used together with NID to identify an MBS Session.

If the request type is "existing PDU session", the SMF shall not perform network slice admission control for the PDU session, except for the following cases:

a) when EPS counting is not required for the S-NSSAI of the PDU session for network slice admission control and the PDU session is established due to transfer the PDN connection from S1 mode to N1 mode in case of inter-system change; or

b) handover of an existing PDU session between 3GPP access and non-3GPP access is performed.

The SMF shall send the PDU SESSION ESTABLISHMENT ACCEPT message.

Upon receipt of a PDU SESSION ESTABLISHMENT ACCEPT message and a PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5, the UE shall stop timer T3580, shall release the allocated PTI value and shall consider that the PDU session was established.

If the PDU session establishment procedure was initiated to perform handover of an existing PDU session between 3GPP access and non-3GPP access, then upon receipt of the PDU SESSION ESTABLISHMENT ACCEPT message the UE shall locally delete any authorized QoS rules, authorized QoS flow descriptions, the session-AMBR and the parameters provided in the Protocol configuration options IE when in S1 mode or the Extended protocol configuration options IE stored for the PDU session before processing the new received authorized QoS rules, authorized QoS flow descriptions, the session-AMBR and the parameters provided in the Extended protocol configuration options IE, if any.

NOTE 9: For the case of handover from 3GPP access to non-3GPP access, deletion of the QoS flow descriptions implies deletion of the associated EPS bearer identities, if any, and according to subclause 6.1.4.1 also deletion of the associated EPS bearer contexts. Regarding the reverse direction, for PDU sessions via non-3GPP access the network does not allocate associated EPS bearer identities (see 3GPP TS 23.502 [9], subclause 4.11.1.4.1).

If the PDU session establishment procedure was initiated to perform handover of an existing PDU session from 3GPP access to non-3GPP access and that existing PDU session is associated with one or more multicast MBS sessions, the

UE shall locally leave the associated multicast MBS sessions and the SMF shall consider the UE as removed from the associated multicast MBS sessions.

For an MA PDU session already established on a single access, except for all those MA PDU sessions with a PDN connection established as a user-plane resource, upon receipt of PDU SESSION ESTABLISHMENT ACCEPT message over the other access:

a) the UE shall delete the stored authorized QoS rules and the stored session-AMBR;

b) if the authorized QoS flow descriptions IE is included in the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall delete the stored authorized QoS flow descriptions; and

c) if the mapped EPS bearer contexts IE is included in the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall delete the stored mapped EPS bearer contexts.

If the UE supports network slice usage control and:

a) a PDU session is successfully established for the on-demand S-NSSAI, the UE shall stop and reset the slice deregistration inactivity timer for the on-demand S-NSSAI over corresponding access type, if running; and

b) an MA PDU session is successfully established for the on-demand S-NSSAI, the UE shall stop and reset the slice deregistration inactivity timer for the on-demand S-NSSAI over both 3GPP access and non-3GPP access, if running.

The UE shall store the authorized QoS rules, and the session-AMBR received in the PDU SESSION ESTABLISHMENT ACCEPT message for the PDU session. The UE shall also store the authorized QoS flow descriptions if it is included in the Authorized QoS flow descriptions IE of the PDU SESSION ESTABLISHMENT ACCEPT message for the PDU session.

If the number of the authorized QoS rules, the number of the packet filters, or the number of the authorized QoS flow descriptions associated with the PDU session have reached the maximum number supported by the UE upon receipt of a PDU SESSION ESTABLISHMENT ACCEPT message, then the UE may initiate the PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #26 "insufficient resources".

For a PDU session that is being established with the request type set to "initial request", "initial emergency request" or "MA PDU request", or a PDU session that is being transferred from EPS to 5GS and established with the request type set to "existing PDU session" or "existing emergency PDU session" or a PDU session that is being handed over between non-3GPP access and 3GPP access and established with the request type set to "existing PDU session" or "existing emergency PDU session ", the UE shall verify the authorized QoS rules and the authorized QoS flow descriptions provided in the PDU SESSION ESTABLISHMENT ACCEPT message for different types of errors as follows:

a) Semantic errors in QoS operations:

   1) When the rule operation is "Create new QoS rule", and the DQR bit is set to "the QoS rule is the default QoS rule" when there's already a default QoS rule.

   2) When the rule operation is "Create new QoS rule", and there is no rule with the DQR bit set to "the QoS rule is the default QoS rule".

   3) When the rule operation is "Create new QoS rule" and two or more QoS rules associated with this PDU session would have identical precedence values.

   4) When the rule operation is an operation other than "Create new QoS rule".

   5) When the rule operation is "Create new QoS rule", the DQR bit is set to "the QoS rule is not the default QoS rule", and the UE is in NB-N1 mode.

   6) When the rule operation is "Create new QoS rule" and there is already an existing QoS rule with the same QoS rule identifier.

   7) When the rule operation is "Create new QoS rule", the DQR bit is set to "the QoS rule is not the default QoS rule", and the PDU session type of the PDU session is "Unstructured".

   8) When the flow description operation is an operation other than "Create new QoS flow description".

8a) When the flow description operation is "Create new QoS flow description" and there is already an existing QoS flow description with the same QoS flow identifier.

9) When the flow description operation is "Create new QoS flow description", the QFI associated with the QoS flow description is not the same as the QFI of the default QoS rule and the UE is NB-N1 mode.

10) When the flow description operation is "Create new QoS flow description", the QFI associated with the QoS flow description is not the same as the QFI of the default QoS rule, and the PDU session type of the PDU session is "Unstructured".

11) When the rule operation is "Create new QoS rule" and the DQR bit is set to "the QoS rule is not the default QoS rule" and one match-all packet filter is to be associated with the QoS rule.

In case 4, case 5, or case 7 if the rule operation is for a non-default QoS rule, the UE shall send a PDU SESSION MODIFICATION REQUEST message to delete the QoS rule with 5GSM cause #83 "semantic error in the QoS operation".

In case 6, if the existing QoS rule is not the default QoS rule and the DQR bit of the new QoS rule is set to "the QoS rule is not the default QoS rule", the UE shall not diagnose an error, further process the create request and, if it was processed successfully, delete the old QoS rule (i.e. the QoS rule that existed when case 6 was detected). If the existing QoS rule is the default QoS rule or the DQR bit of the new QoS rule is set to "the QoS rule is the default QoS rule", the UE shall initiate a PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #83 "semantic error in the QoS operation".

In case 8, case 9, or case 10, the UE shall send a PDU SESSION MODIFICATION REQUEST message to delete the QoS flow description with 5GSM cause #83 "semantic error in the QoS operation".

In case 8a, the UE shall not diagnose an error, further process the create request and, if it was processed successfully, delete the old QoS flow description (i.e. the QoS flow description that existed when case 8a was detected).

Otherwise for all the cases above, the UE shall initiate a PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #83 "semantic error in the QoS operation".

b) Syntactical errors in QoS operations:

1) When the rule operation is "Create new QoS rule", the QoS rule is a QoS rule of a PDU session of IPv4, IPv6, IPv4v6 or Ethernet PDU session type, and the packet filter list in the QoS rule is empty.

2) When the rule operation is "Create new QoS rule", the DQR bit is set to "the QoS rule is the default QoS rule", the PDU session type of the PDU session is "Unstructured", and the packet filter list in the QoS rule is not empty.

3) When there are other types of syntactical errors in the coding of the Authorized QoS rules IE or the Authorized QoS flow descriptions IE, such as: a mismatch between the number of packet filters subfield and the number of packet filters in the packet filter list when the rule operation is create new QoS rule", or the number of packet filters subfield is larger than the maximum possible number of packet filters in the packet filter list (i.e., there is no QoS rule precedence subfield included in the QoS rule IE), the QoS Rule Identifier is set to "no QoS rule identifier assigned", or the QoS flow identifier is set to "no QoS flow identifier assigned".

4) When, the rule operation is "Create new QoS rule", there is no QoS flow description with a QFI corresponding to the QFI of the resulting QoS rule and the UE determines, by using the QoS rule's QFI as the 5QI, that there is a resulting QoS rule for a GBR QoS flow (as described in 3GPP TS 23.501 [8] table 5.7.4-1).

5) When the flow description operation is "Create new QoS flow description", and the UE determines that there is a QoS flow description of a GBR QoS flow (as described in 3GPP TS 23.501 [8] table 5.7.4-1) which lacks at least one of the mandatory parameters (i.e., GFBR uplink, GFBR downlink, MFBR uplink and MFBR downlink). If the QoS flow description does not include a 5QI, the UE determines this by using the QFI as the 5QI.

In case 1, case 3 or case 4, if the QoS rule is the default QoS rule, the UE shall initiate a PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #84 "syntactical error in the QoS operation". Otherwise, the UE shall send a PDU SESSION MODIFICATION REQUEST message

including a requested QoS rule IE, a requested QoS flow description IE or both to delete the QoS rule, the QoS flow description or both with 5GSM cause #84 "syntactical error in the QoS operation".

In case 2, if the QoS rule is the default QoS rule, the UE shall send a PDU SESSION MODIFICATION REQUEST message including a requested QoS rule IE to delete all the packet filters of the default QoS rule. The UE shall include the 5GSM cause #84 "syntactical error in the QoS operation".

In case 5, if the default QoS rule is associated with the QoS flow description which lacks at least one of the mandatory parameters, the UE shall initiate a PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #84 "syntactical error in the QoS operation". Otherwise, the UE shall send a PDU SESSION MODIFICATION REQUEST message to delete the QoS flow description which lacks at least one of the mandatory parameters and the associated QoS rule(s), if any, with 5GSM cause #84 "syntactical error in the QoS operation".

NOTE 10: It is not considered an error if the UE determines that after processing all QoS operations on QoS rules and QoS flow descriptions there is a QoS flow description that is not associated with any QoS rule and the UE is not in NB-N1 mode.

c) Semantic errors in packet filters:

1) When a packet filter consists of conflicting packet filter components which would render the packet filter ineffective, i.e. no IP packet will ever fit this packet filter. How the UE determines a semantic error in a packet filter is outside the scope of the present document.

If the QoS rule is the default QoS rule, the UE shall initiate a PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #44 "semantic error in packet filter(s)". Otherwise, the UE shall send a PDU SESSION MODIFICATION REQUEST message to delete the QoS rule with 5GSM cause #44 "semantic error in packet filter(s)".

d) Syntactical errors in packet filters:

1) When the rule operation is "Create new QoS rule" and two or more packet filters in the resultant QoS rule would have identical packet filter identifiers.

2) When there are other types of syntactical errors in the coding of packet filters, such as the use of a reserved value for a packet filter component identifier.

If the QoS rule is the default QoS rule, the UE shall initiate a PDU session release procedure by sending a PDU SESSION RELEASE REQUEST message with 5GSM cause #45 "syntactical errors in packet filter(s)". Otherwise, the UE shall send a PDU SESSION MODIFICATION REQUEST message to delete the QoS rule with 5GSM cause #45 "syntactical errors in packet filter(s)".

If the Always-on PDU session indication IE is included in the PDU SESSION ESTABLISHMENT ACCEPT message and:

a) the value of the IE is set to "Always-on PDU session required", the UE shall consider the established PDU session as an always-on PDU session; or

b) the value of the IE is set to "Always-on PDU session not allowed", the UE shall not consider the established PDU session as an always-on PDU session.

The UE shall not consider the established PDU session as an always-on PDU session if the UE does not receive the Always-on PDU session indication IE in the PDU SESSION ESTABLISHMENT ACCEPT message.

The UE shall store the mapped EPS bearer contexts, if received in the PDU SESSION ESTABLISHMENT ACCEPT message. Furthermore, the UE shall also store the association between the QoS flow and the mapped EPS bearer context, for each QoS flow which can be transferred to EPS, based on the received EPS bearer identity parameter in Authorized QoS flow descriptions IE and the mapped EPS bearer contexts. The UE shall check each mapped EPS bearer context for different types of errors as follows:

NOTE 11: An error detected in a mapped EPS bearer context does not cause the UE to discard the Authorized QoS rules IE and Authorized QoS flow descriptions IE included in the PDU SESSION ESTABLISHMENT ACCEPT, if any.

a) Semantic error in the mapped EPS bearer operation:

1) When the operation code is an operation code other than "Create new EPS bearer".

2) When the operation code is "Create new EPS bearer" and there is already an existing mapped EPS bearer context with the same EPS bearer identity associated with any PDU session.

3) When the operation code is "Create new EPS bearer" and the resulting mapped EPS bearer context has invalid mandatory parameters or missing mandatory parameters (e.g., mapped EPS QoS parameters or traffic flow template for a dedicated EPS bearer context).

In case 2, if the existing mapped EPS bearer context is associated with the PDU session that is being established, the UE shall not diagnose an error, further process the create request and, if it was process successfully, delete the old EPS bearer context.

Otherwise, the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #85 "Invalid mapped EPS bearer identity".

b) if the mapped EPS bearer context includes a traffic flow template, the UE shall check the traffic flow template for different types of TFT IE errors as follows:

1) Semantic errors in TFT operations:

i) When the TFT operation is an operation other than "Create new TFT"

The UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #41 "semantic error in the TFT operation".

2) Syntactical errors in TFT operations:

i) When the TFT operation = "Create new TFT" and the packet filter list in the TFT IE is empty.

ii) When there are other types of syntactical errors in the coding of the TFT IE, such as a mismatch between the number of packet filters subfield, and the number of packet filters in the packet filter list.

The UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message with to delete the mapped EPS bearer context 5GSM cause #42 "syntactical error in the TFT operation".

3) Semantic errors in packet filters:

i) When a packet filter consists of conflicting packet filter components which would render the packet filter ineffective, i.e. no IP packet will ever fit this packet filter. How the UE determines a semantic error in a packet filter is outside the scope of the present document.

ii) When the resulting TFT, which is assigned to a dedicated EPS bearer context, does not contain any packet filter which applicable for the uplink direction.

The UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #44 "semantic errors in packet filter(s)".

4) Syntactical errors in packet filters:

i) When the TFT operation = "Create new TFT" and two or more packet filters in the resultant TFT would have identical packet filter identifiers.

ii) When the TFT operation = "Create new TFT" and two or more packet filters in all TFTs associated with this PDN connection would have identical packet filter precedence values.

iii) When there are other types of syntactical errors in the coding of packet filters, such as the use of a reserved value for a packet filter component identifier.

In case ii, if the old packet filters do not belong to the default EPS bearer context, the UE shall not diagnose an error and shall delete the old packet filters which have identical filter precedence values.

In case ii, if one or more old packet filters belong to the default EPS bearer context, the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #45 "syntactical errors in packet filter(s)".

In cases i and iii the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #45 "syntactical error in packet filter(s)".

If the UE detects different errors in the mapped EPS bearer contexts, QoS rules or QoS flow descriptions, the UE may send a single PDU SESSION MODIFICATION REQUEST message to delete the erroneous mapped EPS bearer contexts, QoS rules or QoS flow descriptions. In that case, the UE shall include a single 5GSM cause in the PDU SESSION MODIFICATION REQUEST message.

NOTE 12: The 5GSM cause to use cannot be different from: #41 "semantic error in the TFT operation", #42 "syntactical error in the TFT operation", #44 "semantic error in packet filter(s)", #45 "syntactical errors in packet filter(s)", #83 "semantic error in the QoS operation", #84 "syntactical error in the QoS operation", and #85 "Invalid mapped EPS bearer identity". The selection of a 5GSM cause is up to the UE implementation.

If there are mapped EPS bearer context(s) associated with a PDU session, but none of them is associated with the default QoS rule, the UE shall initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context(s) with 5GSM cause #85 "Invalid mapped EPS bearer identity" and shall locally delete the stored EPS bearer identity (EBI) in all the QoS flow descriptions of the PDU session, if any.

The UE shall only use the Control plane CIoT 5GS optimization for this PDU session if the Control plane only indication is included in the PDU SESSION ESTABLISHMENT ACCEPT message.

If the UE requests the PDU session type "IPv4v6" and:

a) the UE receives the selected PDU session type set to "IPv4" and does not receive the 5GSM cause value #50 "PDU session type IPv4 only allowed"; or

b) the UE receives the selected PDU session type set to "IPv6" and does not receive the 5GSM cause value #51 "PDU session type IPv6 only allowed";

the UE may subsequently request another PDU session for the other IP version using the UE-requested PDU session establishment procedure to the same DNN (or no DNN, if no DNN was indicated by the UE) and the same S-NSSAI associated with (in roaming scenarios) a mapped S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE) with a single address PDN type (IPv4 or IPv6) other than the one already activated.

If the UE requests the PDU session type "IPv4v6", receives the selected PDU session type set to "IPv4" and the 5GSM cause value #50 "PDU session type IPv4 only allowed", the UE shall not subsequently request another PDU session using the UE-requested PDU session establishment procedure to the same DNN (or no DNN, if no DNN was indicated by the UE) and the same S-NSSAI associated with (in roaming scenarios) a mapped S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE) to obtain a PDU session type different from the one allowed by the network until any of the following conditions is fulfilled:

a) the UE is registered to a new PLMN;

b) the UE is switched off;

c) the USIM is removed;

d) the entry in the "list of subscriber data" for the current SNPN is updated if the UE does not support access to an SNPN using credentials from a credentials holder and equivalent SNPNs; or

e) the selected entry of the "list of subscriber data" is updated or USIM is removed for the selected PLMN subscription, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both.

If the UE requests the PDU session type "IPv4v6", receives the selected PDU session type set to "IPv6" and the 5GSM cause value #51 "PDU session type IPv6 only allowed", the UE shall not subsequently request another PDU session using the UE-requested PDU session establishment procedure to the same DNN (or no DNN, if no DNN was indicated by the UE) and the same S-NSSAI associated with (in roaming scenarios) a mapped S-NSSAI (or no S-NSSAI, if no S-

NSSAI was indicated by the UE) to obtain a PDU session type different from the one allowed by the network until any of the following conditions is fulfilled:

a) the UE is registered to a new PLMN;

b) the UE is switched off;

c) the USIM is removed

d) the entry in the "list of subscriber data" for the current SNPN is updated if the UE does not support access to an SNPN using credentials from a credentials holder and equivalent SNPNs; or

e) the selected entry of the "list of subscriber data" is updated or USIM is removed for the selected PLMN subscription, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both.

NOTE 13: For the 5GSM cause values #50 "PDU session type IPv4 only allowed", and #51 "PDU session type IPv6 only allowed", re-attempt in S1 mode for the same DNN (or no DNN, if no DNN was indicated by the UE) is only allowed using the PDU session type(s) indicated by the network.

If the selected PDU session type of the PDU session is "Unstructured" or "Ethernet", the UE supports inter-system change from N1 mode to S1 mode, the UE does not support establishment of a PDN connection for the PDN type set to "non-IP" in S1 mode, and the parameters list field of one or more authorized QoS flow descriptions received in the Authorized QoS flow descriptions IE of the PDU SESSION ESTABLISHMENT ACCEPT message contains an EPS bearer identity (EBI), then the UE shall locally remove the EPS bearer identity (EBI) from the parameters list field of such one or more authorized QoS flow descriptions. Additionally the UE shall also initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #85 "Invalid mapped EPS bearer identity".

If the selected PDU session type of the PDU session is "Ethernet", the UE supports inter-system change from N1 mode to S1 mode, the UE does not support establishment of a PDN connection for the PDN type set to "non-IP" in S1 mode, the UE, the network or both of them do not support Ethernet PDN type in S1 mode, and the parameters list field of one or more authorized QoS flow descriptions received in the Authorized QoS flow descriptions IE of the PDU SESSION ESTABLISHMENT ACCEPT message contains an EPS bearer identity (EBI), then the UE shall locally remove the EPS bearer identity (EBI) from the parameters list field of such one or more authorized QoS flow descriptions. Additionally, the UE shall also initiate a PDU session modification procedure by sending a PDU SESSION MODIFICATION REQUEST message to delete the mapped EPS bearer context with 5GSM cause #85 "Invalid mapped EPS bearer identity".

For a UE which is registered for disaster roaming services and for a PDU session which is not a PDU session for emergency services:

a) if the parameters list field of one or more authorized QoS flow descriptions received in the Authorized QoS flow descriptions IE of the PDU SESSION ESTABLISHMENT ACCEPT message contains an EPS bearer identity (EBI), then the UE shall locally remove the EPS bearer identity (EBI) from the parameters list field of such one or more authorized QoS flow descriptions; and

b) the UE shall locally delete the contents of the Mapped EPS bearer contexts IE if it is received in the PDU SESSION ESTABLISHMENT ACCEPT message.

If the UE receives an IPv4 Link MTU parameter, an Ethernet Frame Payload MTU parameter, an Unstructured Link MTU parameter, or a Non-IP Link MTU parameter in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall pass to the upper layer the received IPv4 link MTU size, the received Ethernet frame payload MTU size, the unstructured link MTU size, or the non-IP link MTU size.

NOTE 14: The IPv4 link MTU size corresponds to the maximum length of user data packet that can be sent either via the control plane or via N3 interface for a PDU session of the "IPv4" PDU session type.

NOTE 15: The Ethernet frame payload MTU size corresponds to the maximum length of a payload of an Ethernet frame that can be sent either via the control plane or via N3 interface for a PDU session of the "Ethernet" PDU session type.

NOTE 16: The unstructured link MTU size correspond to the maximum length of user data packet that can be sent either via the control plane or via N3 interface for a PDU session of the "Unstructured" PDU session type.

NOTE 17: A PDU session of "Ethernet" or "Unstructured" PDU session type can be transferred to a PDN connection of "non-IP" PDN type, thus the UE can request the non-IP link MTU parameter in the PDU session establishment procedure. The non-IP link MTU size corresponds to the maximum length of user data that can be sent either in the user data container in the ESM DATA TRANSPORT message or via S1-U interface as specified in 3GPP TS 24.301 [15].

If the 5G-RG receives an ACS information parameter in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT ACCEPT message, the 5G-RG shall pass the ACS URL in the received ACS information parameter to the upper layer.

If the UE has indicated support for CIoT 5GS optimizations and receives a small data rate control parameters container in the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall store the small data rate control parameters value and use the stored small data rate control parameters value as the maximum allowed limit of uplink user data for the PDU session in accordance with 3GPP TS 23.501 [8].

If the UE has indicated support for CIoT 5GS optimizations and receives an additional small data rate control parameters for exception data container in the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall store the additional small data rate control parameters for exception data value and use the stored additional small data rate control parameters for exception data value as the maximum allowed limit of uplink exception data for the PDU session in accordance with 3GPP TS 23.501 [8].

If the UE has indicated support for CIoT 5GS optimizations and receives an initial small data rate control parameters container or an initial additional small data rate control parameters for exception data container in the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall use these parameters for the newly established PDU Session. When the validity period of the initial parameters expire, the parameters received in a small data rate control parameters container or an additional small data rate control parameters for exception data container shall be used.

If the UE receives a Serving PLMN rate control IE in the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall store the Serving PLMN rate control IE value and use the stored serving PLMN rate control value as the maximum allowed limit of uplink control plane user data for the corresponding PDU session in accordance with 3GPP TS 23.501 [8].

If the UE receives an APN rate control parameters container or an additional APN rate control for exception data parameters container in the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall store these parameters and use them to limit the rate at which it generates uplink user data messages for the PDN connection corresponding to the PDU session if the PDU session is transferred to EPS upon inter-system change from N1 mode to S1 mode in accordance with 3GPP TS 24.301 [15]. The received APN rate control parameters and additional APN rate control for exception data parameters shall replace any previously stored APN rate control parameters and additional APN rate control for exception data parameters, respectively, for this PDN connection.

If the UE receives an initial APN rate control parameters container or an initial additional APN rate control for exception data parameters container in the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall store these parameters in the APN rate control status and use them to limit the rate at which it generates exception data messages for the PDN connection corresponding to the PDU session if the PDU session is transferred to EPS upon inter-system change from N1 mode to S1 mode in accordance with 3GPP TS 24.301 [15]. The received APN rate control status shall replace any previously stored APN rate control status for this PDN connection.

NOTE 18: In the PDU SESSION ESTABLISHMENT ACCEPT message, the SMF provides either APN rate control parameters container, or initial APN rate control parameters container, in the Extended protocol configuration options IE, but not both.

NOTE 19: In the PDU SESSION ESTABLISHMENT ACCEPT message, the SMF provides either additional APN rate control for exception data parameters container, or initial additional APN rate control for exception data parameters container, in the Extended protocol configuration options IE, but not both.

If the network accepts the use of Reliable Data Service to transfer data for the PDU session, the network shall include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message and include the Reliable Data Service accepted indicator. The UE behaves as described in subclause 6.2.15.

If

- the UE indicates support of DNS over (D)TLS by providing DNS server security information indicator to the network;

- optionally, the UE indicates which security protocol type(s) are supported by the UE, by providing the DNS server security protocol support to the network; and

- the network wants to enforce the use of DNS over (D)TLS,

the network may include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message and include the DNS server security information with length of two octets. Upon receiving the DNS server security information, the UE shall pass it to the upper layer. The UE shall use this information to send the DNS over (D)TLS (See 3GPP TS 33.501 [24]).

NOTE 20: Support of DNS over (D)TLS is based on the requirements as specified in 3GPP TS 33.501 [24] and it is implemented based on the operator requirement.

If the PDU SESSION ESTABLISHMENT REQUEST message includes the Service-level-AA container IE with the service-level device ID set to the CAA-level UAV ID, and the SMF is provided by the UAS-NF the successful UUAA-SM result and the CAA-level UAV ID, the SMF shall store the successful result together with the authorized CAA-level UAV ID and transmit the PDU SESSION ESTABLISHMENT ACCEPT message to the UE, where the PDU SESSION ESTABLISHMENT ACCEPT message shall include the Service-level-AA container IE containing:

a) the service-level-AA response, with the SLAR field set to "Service level authentication and authorization was successful";

b) the service-level device ID with the value set to the CAA-level UAV ID; and

c) if a payload is received from the UAS-NF,the service-level-AA payload, with the value set to the payload;

d) if a payload type associated with the payload is received from the UAS-NF, the service-level-AA payload type with the values set to the associated payload type.

NOTE 21: UAS security information can be included in the UUAA payload by the USS as specified in 3GPP TS 33.256 [24B].

If the network accepts the request of the PDU session establishment for C2 communication, the network shall send the PDU SESSION ESTABLISHMENT ACCEPT message including the Service-level-AA container IE containing:

a) the service-level-AA response with the value of C2AR field set to the "C2 authorization was successful";

b) if a payload is provided from the UAS-NF, the service-level-AA payload with the value set to the payload;

c) if a payload type associated with the payload is provided from the UAS-NF, the service-level-AA payload type with the value set to the payload type; and

d) if the CAA-level UAV ID is provided from the UAS-NF, the service-level device ID with the value set to the CAA-level UAV ID.

NOTE 22: The C2 authorization payload in the service-level-AA payload can include one or both of the C2 session security information, and pairing information for direct C2 communication.

Upon receipt of the PDU SESSION ESTABLISHMENT ACCEPT message of the PDU session for C2 communication, if the Service-level-AA container IE is included, the UE shall forward the service-level-AA contents of the Service-level-AA container IE to the upper layers.

The SMF may be configured with one or more PVS IP addresses or PVS names or both associated with the DNN and S-NSSAI used for onboarding services in SNPN, for configuration of SNPN subscription parameters in PLMN via the user plane, or for configuration of a UE via the user plane with credentials for NSSAA or PDU session authentication and authorization procedure. If the PDU session was established for onboarding services in SNPN, or the PVS information request is included in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT REQUEST message establishing a PDU session providing connectivity for configuration of SNPN subscription parameters in PLMN via the user plane, the network may include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message and include the PVS IP address(es) or the PVS name(s) or both associated with the DNN and S-NSSAI of the established PDU session, if available. If the PVS information request is included in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT REQUEST message establishing the PDU session providing connectivity for configuration of a

UE via the user plane with credentials for PDU session authentication and authorization procedure, based on the subscribed DNN(s) and S-NSSAI(s) of the UE and the DNN and S-NSSAI of the established PDU session, the network should include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message and include the PVS IP address(es) or the PVS name(s) or both, which are associated with the established PDU session and per subscribed DNN(s) and S-NSSAI(s) of the UE, if available. If the PVS information request is included in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT REQUEST message establishing the PDU session providing connectivity for configuration of a UE via the user plane with credentials for NSSAA, based on the subscribed S-NSSAI(s) of the UE and the S-NSSAI of the established PDU session, the network should include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message and include the PVS IP address(es) or the PVS name(s) or both, which are associated with the established PDU session and per subscribed S-NSSAI(s) of the UE, if available.

NOTE 23: If the PVS information request is included in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT REQUEST message establishing a PDU session providing connectivity for configuration of SNPN subscription parameters in SNPN via the user plane by a UE which is not registered for onboarding services in SNPN, the SMF can include the PVS IP address(es) or the PVS name(s) or both, associated with the DNN and S-NSSAI of the established PDU session, if available, in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT ACCEPT message.

NOTE 24: The PVS IP address(es) or the PVS name(s) or both in the SMF can either be locally configured or provided by DCS. The SMF can send the PVS IP address(es) or the PVS name(s) or both that are available in the SMF as the PVS IP address(es) or the PVS name(s) or both to the UE, respectively. If the PDU session was established for onboarding services in SNPN not supporting localized services in SNPN, the PVS IP address(es) or the PVS name(s) or both provided by DCS takes precedence over the PVS IP address(es) or the PVS name(s) or both locally configured, respectively. If the PDU session was established for onboarding services in SNPN supporting localized services in SNPN, the SMF can include both the DCS provided PVS IP address(es) or the PVS name(s) or both associated with the DNN and S-NSSAI of the established PDU session and the locally configured PVS IP address(es) or the PVS name(s) or both associated with the DNN and S-NSSAI of the established PDU session, if available.

The UE upon receiving one or more PVS IP address(es), if any, one or more the PVS name(s), if any, or both shall pass them to the upper layers.

NOTE 25: If several PVS IP addresses, several PVS name(s), or one or more PVS IP addresses and one or more PVS name(s) are received, how the UE uses this information is up to UE implementation.

If the UE indicates support for ECS configuration information provisioning by providing the ECS configuration information provisioning support indicator in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT REQUEST message, then the SMF may include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message with

a) at least one of ECS IPv4 Address(es), ECS IPv6 Address(es), and ECS FQDN(s);

b) at least one associated ECSP identifier;

c) optionally, spatial validity conditions associated with the ECS address;

d) optionally, ECS authentication methods associated with the ECS address; and

e) optionally, ECS supported PLMNs information list, including the associated ECSP information for which the EDN configuration information can be provided by the ECS.

The UE upon receiving one or more ECS IPv4 address(es), if any, ECS IPv6 address(es), if any, or ECS FQDN(s), if any, with the associated spatial validity condition, if any, the associated ECS authentication methods, if any, ECS supported PLMNs information list, if any and an ECSP identifier shall pass them to the upper layers.

NOTE 26: The IP address(es), FQDN(s), or both are associated with the ECSP identifier and replace previously provided ECS configuration information associated with the same ECSP identifier, if any.

If the SMF needs to provide DNS server address(es) to the UE and the UE has provided the DNS server IPv4 address request, the DNS server IPv6 address request or both of them, in the PDU SESSION ESTABLISHMENT REQUEST message, then the SMF shall include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message with one or more DNS server IPv4 address(es), one or more DNS server IPv6

address(es) or both of them. If the UE supports receiving DNS server addresses in protocol configuration options and receives one or more DNS server IPv4 address(es), one or more DNS server IPv6 address(es) or both of them, in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT ACCEPT message, then the UE shall pass the received DNS server IPv4 address(es), if any, and the received DNS server IPv6 address(es), if any, to upper layers.

NOTE 27: The received DNS server address(es) replace previously provided DNS server address(es), if any.

If the PDU SESSION ESTABLISHMENT ACCEPT message includes the Received MBS container IE, for each of the Received MBS information:

a) if MBS decision is set to "MBS join is accepted", the UE shall consider that it has successfully joined the multicast MBS session. The UE shall store the received TMGI and shall use it for any further operation on that multicast MBS session. The UE shall store the received MBS service area associated with the received TMGI, if any, and provide the received TMGI to lower layers. The UE may provide the MBS start time if it is included in the Received MBS information to upper layers; or

b) if MBS decision is set to "MBS join is rejected", the UE shall consider the requested join as rejected. The UE shall store the received MBS service area associated with the received TMGI, if any. If the received Rejection cause is set to "User is outside of local MBS service area", the UE shall not request to join the same multicast MBS session if neither current TAI nor CGI of the current cell is part of the received MBS service area. If the received Rejection cause is set to "multicast MBS session has not started or will not start soon" and an MBS back-off timer value is included with value that indicates neither zero nor deactivated, the UE shall start a back-off timer T3587 with the value provided in the MBS back-off timer value for the received TMGI, and shall not attempt to join the multicast MBS session with the same TMGI until the expiry of T3587. If the MBS back-off timer value indicates that this timer is deactivated, the UE shall not attempt to join the multicast MBS session with the same TMGI, the Source IP address information of the TMGI, or the Destination IP address information of the TMGI until the UE is switched off, the USIM is removed, or the entry in the "list of subscriber data" for the current SNPN is updated. If the MBS back-off timer value indicates zero, the UE may attempt to join the multicast MBS session with the same TMGI.

If the PDU session is established for IMS signalling and the UE has requested P-CSCF IPv6 address or P-CSCF IPv4 address, the SMF shall include P-CSCF IP address(es) in the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message.

NOTE 28: The P-CSCF selection functionality is specified in subclause 5.16.3.11 of 3GPP TS 23.501 [8].

Upon receipt of the PDU SESSION ESTABLISHMENT ACCEPT message, if the UE included the PDU session pair ID in the PDU SESSION ESTABLISHMENT REQUEST message, the UE shall associate the PDU session with the PDU session pair ID. If the UE included the RSN in the PDU SESSION ESTABLISHMENT REQUEST message, the UE shall associate the PDU session with the RSN.

If the PDU SESSION ESTABLISHMENT ACCEPT message include alternative S-NSSAI, the S-NSSAI for the established PDU session shall be the S-NSSAI to be replaced and the alternative S-NSSAI on the UE side.

If the UE supports EDC and the network allows the use of EDC, the SMF shall include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message with the EDC usage allowed indicator. If the UE supports EDC and receives the EDC usage allowed indicator in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall indicate to upper layers that network allows the use of EDC.

If the UE supports EDC and the network requires the use of EDC, the SMF shall include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message with the EDC usage required indicator. If the UE supports EDC and receives the EDC usage required indicator in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall indicate to upper layers that network requires the use of EDC.

If the PDU SESSION ESTABLISHMENT REQUEST message includes a MS support of MAC address range in 5GS indicator in the Extended protocol configuration options IE, the SMF:

a) shall consider that the UE supports a "destination MAC address range type" packet filter component and a "source MAC address range type" packet filter component; and

b) if the SMF supports a "destination MAC address range type" packet filter component and a "source MAC address range type" packet filter component and enables the UE to request QoS rules with a "destination MAC address range type" packet filter component and a "source MAC address range type" packet filter component, shall include the Extended protocol configuration options IE in the PDU SESSION ESTABLISHMENT ACCEPT message and shall include the Network support of MAC address range in 5GS indicator in the Extended protocol configuration options IE.

If the UE receives the 5GSM network feature support IE in the PDU SESSION ESTABLISHMENT ACCEPT message with the non-3GPP access path switching bit set to "non-3GPP access path switching supported" during the PDU session establishment procedure of any PDU session, the UE may include the NSONR bit with value set to "non-3GPP path switching while using old non-3GPP resources requested" in the Non-3GPP path switching information IE in the REGISTRATION REQUEST message while performing the registration procedure for mobility registration update for non-3GPP access path switching.

NOTE 29: If the UE is registered to different PLMNs over 3GPP and non-3GPP accesses, the UE uses the capability received over non-3GPP access to determine whether to initiate the registration procedure for mobility registration update for non-3GPP path switching.

NOTE 30: If the AMF selects an SMF not supporting non-3GPP access path switching, the non-3GPP access path switching can still be performed with the AMF triggering release of the old user plane resources before new user plane resources are established.

If the PDU SESSION ESTABLISHMENT ACCEPT message includes a Network support of MAC address range in 5GS indicator in the Extended protocol configuration options IE, the UE shall consider that the network supports a "destination MAC address range type" packet filter component and a "source MAC address range type" packet filter component.

NOTE 31: Handling of indication that network allows the use of EDC or that network requires the use of EDC is specified in 3GPP TS 23.548 [182].

If the SMF includes the authorized QoS flow descriptions and the SMF determines to provide the N3QAI to the UE, the SMF shall include the N3QAI IE in the PDU SESSION ESTABLISHMENT ACCEPT message.

If the SMF supports URSP provisioning in EPS and the URSP provisioning in EPS support indicator is included in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT REQUEST message, the SMF shall insert the URSP provisioning in EPS support indicator in the Extended protocol configuration options IE of the PDU SESSION ESTABLISHMENT ACCEPT message.

If the PDU session to be established is a single access PDU session over 3GPP access with IP PDU session type and based on operator policy the SMF determines to provide the protocol description for UL PDU set handling to the UE, the SMF may include the Protocol description IE in the PDU SESSION ESTABLISHMENT ACCEPT message.

If the Protocol description IE is included in the PDU SESSION ESTABLISHMENT ACCEPT message, the UE shall, for each existing QoS rule, store the associated protocol description included in the Protocol description IE. The UE may use the protocol description information associated with the QoS rule(s) provided by the Protocol description IE to identify PDUs belonging to PDU sets for the uplink direction.

NOTE 32: Whether and how to use the protocol description information to identify PDU sets is up to the UE implementation.

6.4.1.4 UE-requested PDU session establishment procedure not accepted by the network

6.4.1.4.1 General

If the connectivity with the requested DN is rejected by the network, the SMF shall create a PDU SESSION ESTABLISHMENT REJECT message.

The SMF shall set the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message to indicate the reason for rejecting the PDU session establishment.

The 5GSM cause IE typically indicates one of the following SM cause values:

#8 operator determined barring;

#26 insufficient resources;

#27 missing or unknown DNN;

#28 unknown PDU session type;

#29 user authentication or authorization failed;

#31 request rejected, unspecified;

#32 service option not supported;

#33 requested service option not subscribed;

#35 PTI already in use;

#38 network failure;

#39 reactivation requested;

#46 out of LADN service area;

#50 PDU session type IPv4 only allowed;

#51 PDU session type IPv6 only allowed;

#54 PDU session does not exist;

#57: PDU session type IPv4v6 only allowed;

#58: PDU session type Unstructured only allowed;

#61: PDU session type Ethernet only allowed;

#67 insufficient resources for specific slice and DNN;

#68 not supported SSC mode;

#69 insufficient resources for specific slice;

#70 missing or unknown DNN in a slice;

#82 maximum data rate per UE for user-plane integrity protection is too low;

#86 UAS services not allowed; or

#95 – 111 protocol errors.

If the PDU SESSION ESTABLISHMENT REQUEST message includes a PDU session type IE set to "IPv6", and the subscription, the SMF configuration, or both, are limited to IPv4 only for the requested DNN, the SMF shall include the 5GSM cause value #50 "PDU session type IPv4 only allowed" in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message.

If the PDU SESSION ESTABLISHMENT REQUEST message includes a PDU session type IE set to "IPv6", and the subscription, the SMF configuration, or both, support none of "IPv4" and "IPv6" PDU session types for the requested DNN, the SMF shall include the 5GSM cause value #28 "unknown PDU session type" in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message.

If the PDU SESSION ESTABLISHMENT REQUEST message includes a PDU session type IE set to "IPv4", and the subscription, the SMF configuration, or both, are limited to IPv6 only for the requested DNN, the SMF shall include the 5GSM cause value #51 "PDU session type IPv6 only allowed" in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message.

If the PDU SESSION ESTABLISHMENT REQUEST message includes a PDU session type IE set to "IPv4", and the subscription, the SMF configuration, or both, support none of "IPv4" and "IPv6" PDU session types for the requested DNN, the SMF shall include the 5GSM cause value #28 "unknown PDU session type" in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message.

If the PDU SESSION ESTABLISHMENT REQUEST message includes a PDU session type IE set to "IPv4v6", and the subscription, the SMF configuration, or both, support none of "IPv4v6", "IPv4" and "IPv6" PDU session types for the requested DNN, the SMF shall include the 5GSM cause value #28 "unknown PDU session type" in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message.

If the PDU SESSION ESTABLISHMENT REQUEST message includes a PDU session type IE set to "Unstructured" or "Ethernet", and the subscription, the SMF configuration, or both, do not support the PDU session type for the requested DNN, the SMF shall include the 5GSM cause value #28 "unknown PDU session type" in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message.

If the PDU SESSION ESTABLISHMENT REQUEST message is to establish an MA PDU session and includes a PDU session type IE set to "Unstructured", and the SMF configuration does not support the PDU session type, the SMF shall include the 5GSM cause value #28 "unknown PDU session type" in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message.

If the PDU SESSION ESTABLISHMENT REQUEST message contains the SSC mode IE indicating an SSC mode not supported by the subscription, the SMF configuration, or both of them, and the SMF decides to rejects the PDU session establishment, the SMF shall include the 5GSM cause value #68 "not supported SSC mode" in the 5GSM cause IE and the SSC modes allowed by SMF in the Allowed SSC mode IE of the PDU SESSION ESTABLISHMENT REJECT message.

If the PDU SESSION ESTABLISHMENT REQUEST message is to establish an MA PDU session and MA PDU session is not allowed due to operator policy and subscription, and the SMF decides to reject the PDU session establishment, the SMF shall include the 5GSM cause value #33 "requested service option not subscribed" in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message.

If the PDU SESSION ESTABLISHMENT REQUEST message is identified to be for C2 communication and:

a) does not include the Service-level-AA container IE with the service-level device ID set to the CAA-level UAV ID;

b) does not include the Service-level-AA container IE with the service-level-AA payload and the Service-level-AA payload type; or

c) the SMF is informed by the UAS-NF that the UAS service is not allowed,

the SMF shall reject the PDU SESSION ESTABLISHMENT REQUEST message by transmitting a PDU SESSION ESTABLISHMENT REJECT message with 5GSM cause IE set to 5GSM cause value #86 "UAS services not allowed".

In 3GPP access, if the operator's configuration requires user-plane integrity protection for the PDU session and, the maximum data rate per UE for user-plane integrity protection supported by the UE for uplink or the maximum data rate per UE for user-plane integrity protection supported by the UE for downlink, or both, are lower than required by the operator's configuration, the SMF shall include the 5GSM cause value #82 "maximum data rate per UE for user-plane integrity protection is too low" in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message.

If the UE requests a PDU session establishment for an LADN when the UE is located outside of the LADN service area, the SMF shall include the 5GSM cause value #46 "out of LADN service area" in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message.

If the DN authentication of the UE was performed with the PDU session authentication and authorization procedure and completed unsuccessfully, the SMF shall include the 5GSM cause value #29 "user authentication or authorization failed" in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message and shall set the EAP message IE of the PDU SESSION ESTABLISHMENT REJECT message to an EAP-failure message as specified in IETF RFC 3748 [34], provided by the DN.

If the DN authentication of the UE was performed with the service-level authentication and authorization procedure and completed unsuccessfully, the SMF shall include the 5GSM cause value #29 "user authentication or authorization failed" in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message and shall include the service-level-AA response provided by DN in the Service-level-AA container IE of the PDU SESSION ESTABLISHMENT REJECT message.

Based on the local policy and user's subscription data, if a PDU session is being established with the request type set to "existing PDU session" and the SMF determines the UE has:

a) moved between a tracking area in NB-N1 mode and a tracking area in WB-N1 mode;

b) moved between a tracking area in NB-S1 mode and a tracking area in WB-N1 mode; or

c) moved between a tracking area in WB-S1 mode and a tracking area in NB-N1 mode,

the SMF may reject the PDU SESSION ESTABLISHMENT REQUEST message and:

a) include the 5GSM cause value #39 "reactivation requested" in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message; or

b) include a 5GSM cause value other than #39 "reactivation requested" in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message.

NOTE 1: The included 5GSM cause value is up to the network implementation.

If the PDU session cannot be established due to resource unavailability in the UPF, the SMF shall include the 5GSM cause value #26 "insufficient resources" in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message.

Based on the user's subscription data and the operator policy, if the SMF determines that the UUAA-SM procedure needs to be performed for a UE but the SMF does not receives the service-level device ID set to the CAA-level UAV ID in the Service-level-AA container IE of the PDU SESSION ESTABLISHMENT REQUEST message from the UE, the SMF shall include the 5GSM cause value #86 "UAS services not allowed" in the 5GSM cause IE of the PDU SESSION ESTABLISHMENT REJECT message.

The network may include a Back-off timer value IE in the PDU SESSION ESTABLISHMENT REJECT message.

If the 5GSM cause value is #26 "insufficient resources", #67 "insufficient resources for specific slice and DNN", or #69 "insufficient resources for specific slice" and the PDU SESSION ESTABLISHMENT REQUEST message was received from a UE configured for high priority access in selected PLMN or SNPN or the request type provided during the PDU session establishment is set to "initial emergency request" or "existing emergency PDU session", the network shall not include a Back-off timer value IE.

If the 5GSM cause value is #29 "user authentication or authorization failed ", the network should include a Back-off timer value IE.

If the Back-off timer value IE is included and the 5GSM cause value is different from #26 "insufficient resources", #28 "unknown PDU session type", #46 "out of LADN service area", #50 "PDU session type IPv4 only allowed", #51 "PDU session type IPv6 only allowed", #54 "PDU session does not exist", #57 "PDU session type IPv4v6 only allowed", #58 "PDU session type Unstructured only allowed", #61 "PDU session type Ethernet only allowed", #67 "insufficient resources for specific slice and DNN", #68 "not supported SSC mode", and #69 "insufficient resources for specific slice", the network may include the Re-attempt indicator IE to indicate whether the UE is allowed to attempt a PDN connectivity procedure in the PLMN for the same DNN in S1 mode, whether another attempt in S1 mode or in N1 mode is allowed in an equivalent PLMN or whether another attempt in N1 mode is allowed in an equivalent SNPN.

If the 5GSM cause value is #50 "PDU session type IPv4 only allowed", #51 "PDU session type IPv6 only allowed", #57 "PDU session type IPv4v6 only allowed", #58 "PDU session type Unstructured only allowed", or #61 "PDU session type Ethernet only allowed", the network may include the Re-attempt indicator IE without Back-off timer value IE to indicate whether the UE is allowed to attempt a PDU session establishment procedure in an equivalent PLMN or equivalent SNPN in N1 mode using the same PDU session type for the same DNN (or no DNN, if no DNN was indicated by the UE) and the same S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE).

The SMF shall send the PDU SESSION ESTABLISHMENT REJECT message.

Upon receipt of a PDU SESSION ESTABLISHMENT REJECT message and a PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5, the UE shall stop timer T3580 shall release the allocated PTI value and shall consider that the PDU session was not established.

If the PDU SESSION ESTABLISHMENT REQUEST message was sent with request type set to "initial emergency request" or "existing emergency PDU session" and the UE receives a PDU SESSION ESTABLISHMENT REJECT message, then the UE may:

a) inform the upper layers of the failure of the procedure; or

NOTE 2: This can result in the upper layers requesting another emergency call attempt using domain selection as specified in 3GPP TS 23.167 [6].

b) de-register locally, if not de-registered already, attempt initial registration for emergency services.

If the PDU SESSION ESTABLISHMENT REJECT message includes 5GSM cause #39 "reactivation requested" and the PDU session is being transferred from EPS to 5GS and established with the request type set to "existing PDU session", the UE should re-initiate the UE-requested PDU session establishment procedure as specified in subclause 6.4.1 for:

a) the PDU session type associated with the transferred PDU session;

b) the SSC mode associated with the transferred PDU session;

c) the DNN associated with the transferred PDU session; and

d) the S-NSSAI associated with (if available in roaming scenarios) a mapped S-NSSAI if provided in the UE-requested PDU session establishment procedure of the transferred PDU session.

If the PDU SESSION ESTABLISHMENT REJECT message includes 5GSM cause #86 "UAS services not allowed" and the UE has not included the service-level device ID in the Service-level-AA container IE of the PDU SESSION ESTABLISHMENT REQUEST message and set the value to the CAA-level UAV ID:

a) the UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for UAS services without including the CAA-level UAV ID in the service-level device ID of the Service-level-AA container IE; and

b) upon receipt of the request from the upper layers to establish a PDU session for UAS services, the UE shall initiate the UE-requested PDU session establishment procedure by including the service-level device ID in the Service-level-AA container IE of the PDU SESSION ESTABLISHMENT REQUEST message and set the value to the CAA-level UAV ID as specified in subclause 6.4.1.2.

If the 5GSM cause value is different from #26 "insufficient resources", #28 "unknown PDU session type", #39 "reactivation requested", #46 "out of LADN service area", #50 "PDU session type IPv4 only allowed", #51 "PDU session type IPv6 only allowed", #54 "PDU session does not exist", #57 "PDU session type IPv4v6 only allowed", #58 "PDU session type Unstructured only allowed", #61 "PDU session type Ethernet only allowed", #67 "insufficient resources for specific slice and DNN", #68 "not supported SSC mode", and #69 "insufficient resources for specific slice", #86 "UAS services not allowed", and #33 "requested service option not subscribed" and the PDU SESSION ESTABLISHMENT REQUEST message was received from a UE configured for high priority access in selected PLMN, the network shall not include a Back-off timer value IE.

6.4.1.4.2 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 ESTABLISHMENT 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 ESTABLISHMENT REQUEST message with the PDU session ID IE set to the PDU session ID of the PDU session;

the UE shall ignore the 5GSM congestion re-attempt indicator or the 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 or SNPN, 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. In an SNPN, the timer T3396 to be stopped includes:

   1) the timer T3396 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

2) the timer T3396 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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, SNPN 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. In an SNPN, the timer T3396 to be stopped includes:

1) the timer T3396 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

2) the timer T3396 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE:

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 until the UE is switched off, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated if the UE does not support access to an SNPN using credentials from a credentials holder, or the selected entry of the "list of subscriber data" is updated if the UE supports access to an SNPN using credentials from a credentials holder, or the UE receives a PDU SESSION MODIFICATION COMMAND message for the same DNN from the network, or a PDU SESSION AUTHENTICATION 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, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated if the UE does not support access to an SNPN using credentials from a credentials holder, or the selected entry of the "list of subscriber data" is updated if the UE supports access to an SNPN using credentials from a credentials holder, 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 AUTHENTICATION 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, SNPN change, or inter-system change; and

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

1) shall stop timer T3396 associated with the corresponding DNN, if running. In an SNPN, the timer T3396 to be stopped includes:

i) the timer T3396 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

ii) the timer T3396 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE 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. In an SNPN, the timer T3396 to be stopped includes:

i) the timer T3396 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

ii) the timer T3396 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE 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.

In an SNPN, if the UE supports equivalent SNPNs, then the UE shall apply the timer T3396 for all the equivalent SNPNs. Otherwise, the UE shall apply the timer T3396 for the registered SNPN.

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 as specified in subclause 6.2.7.

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 timer T3396 is running when the UE enters state 5GMM-DEREGISTERED, the UE remains switched on, and the USIM in the UE (if any) remains the same and the entry in the "list of subscriber data" to which timer T3396 is associated (if any) is not updated, then timer T3396 is kept running until it expires or it is stopped.

If the UE is switched off when the timer T3396 is running, and if the USIM in the UE (if any) remains the same and the entry in the "list of subscriber data" to which timer T3396 is associated (if any) is not updated 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 5GSM cause value #67 "insufficient resources for specific slice and DNN" and the Back-off timer value IE are included in the PDU SESSION ESTABLISHMENT 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 ESTABLISHMENT 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 or SNPN, 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 timer T3584 to be stopped includes:

   1) in a PLMN:

      i) the timer T3584 applied for all the PLMNs, if running; and

      ii) the timer T3584 applied for the registered PLMN, if running; or

   2) in an SNPN:

      i) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

      ii) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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 with exception of those identified in subclause 6.4.2.1, message 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, SNPN 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 running. The timer T3584 to be stopped includes:

      i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated if the UE does not support access to an SNPN using credentials from a credentials holder, or the selected entry of the "list of subscriber data" is updated if the UE supports access to an SNPN using credentials from a credentials holder, or the UE receives a PDU SESSION MODIFICATION COMMAND message for the same [S-NSSAI, DNN] combination from the network, or a PDU SESSION AUTHENTICATION 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 running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated if the UE does not support access to an SNPN using credentials from a credentials holder, or the selected entry of the "list of subscriber data" if the UE supports access to an SNPN using credentials from a credentials holder, 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 AUTHENTICATION COMMAND message for a non-emergency PDU session established 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 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 running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated, or the UE receives a PDU SESSION MODIFICATION COMMAND message for the same [no S-NSSAI, DNN] combination from the network, or a PDU SESSION AUTHENTICATION 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 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 running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated if the UE does not support access to an SNPN using credentials from a credentials holder, or the selected entry of the "list of subscriber data" is updated if the UE supports access to an SNPN using credentials from a credentials holder, 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, SNPN change, or inter-system change; and

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 running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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 running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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 running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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 running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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 with the ABO bit set to "The back-off timer is applied in all PLMNs or all equivalent SNPNs " is included in the PDU SESSION ESTABLISHMENT 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 or all the equivalent SNPNs. 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 as specified in subclause 6.2.8.

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 (if any) remains the same and the entry in the "list of subscriber data" to which timer T3584 is associated (if any) is not updated, 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 (if any) remains the same and the entry in the "list of subscriber data" to which timer T3584 is associated (if any) is not updated 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 5GSM cause value #69 "insufficient resources for specific slice" and the Back-off timer value IE are included in the PDU SESSION ESTABLISHMENT 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 ESTABLISHMENT 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 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 or SNPN, 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 timer T3585 to be stopped includes:

1) in a PLMN:

   i)- the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION ESTABLISHMENT REJECT is received, if running;

   ii) the timer T3585 applied for all the PLMNs and for both 3GPP access type and non-3GPP access type, if running;

   iii) the timer T3585 applied for the registered PLMN and for the access over which the PDU SESSION ESTABLISHMENT REJECT is received, if running; and

   iv) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, if running; or

2) in an SNPN:

   i) the timer T3585 applied for all the equivalent SNPNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

   ii) the timer T3585 applied for all the equivalent SNPNs and for both 3GPP access type and non-3GPP access type, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

   iii) the timer T3585 applied for the registered SNPN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

   iv) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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, SNPN 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 timer T3585 to be stopped includes:

   1) in a PLMN:

i) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION ESTABLISHMENT REJECT is received, if running;

ii) the timer T3585 applied for all the PLMNs and for both 3GPP access type and non-3GPP access type, if running;

iii) the timer T3585 applied for the registered PLMN and for the access over which the PDU SESSION ESTABLISHMENT REJECT is received, if running; and

iv) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, if running; or

2) in an SNPN:

i) the timer T3585 applied for all the equivalent SNPNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

ii) the timer T3585 applied for all the equivalent SNPNs and for both 3GPP access type and non-3GPP access type, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

iii) the timer T3585 applied for the registered SNPN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

iv) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated if the UE does not support access to an SNPN using credentials from a credentials holder, or the selected entry of the "list of subscriber data" is updated if the UE supports access to an SNPN using credentials from a credentials holder, 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 AUTHENTICATION 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, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated if the UE does not support access to an SNPN using credentials from a credentials holder, or the selected entry of the "list of subscriber data" is updated if the UE supports access to an SNPN using credentials from a credentials holder, 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 AUTHENTICATION 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, SNPN change, or inter-system change; and

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

1) shall stop timer T3585 associated with the corresponding S-NSSAI, if running. The timer T3585 to be stopped includes:

i) in a PLMN:

A) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION RELEASE COMMAND is received, if running;

B) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION RELEASE COMMAND is received, if running;

C) the timer T3585 applied for the registered PLMN and for current access type or both 3GPP access type and non-3GPP access type, if running; and

D) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, if running; or

ii) in an SNPN:

A) the timer T3585 applied for all the equivalent SNPNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

B) the timer T3585 applied for all the equivalent SNPNs and for both 3GPP access type and non-3GPP access type, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

C) the timer T3585 applied for the registered SNPN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

D) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE 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. The timer T3585 to be stopped includes:

i) in a PLMN:

A) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION RELEASE COMMAND is received, if running;

B) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION RELEASE COMMAND is received, if running;

C) the timer T3585 applied for the registered PLMN and for current access type or both 3GPP access type and non-3GPP access type, if running; and

D) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, if running; or

ii) in an SNPN:

A) the timer T3585 applied for all the equivalent SNPNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

B) the timer T3585 applied for all the equivalent SNPNs and for both 3GPP access type and non-3GPP access type, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

C) the timer T3585 applied for the registered SNPN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

D) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE 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 with the ABO bit set to "The back-off timer is applied in all PLMNs or equivalent SNPNs " is included in the PDU SESSION ESTABLISHMENT 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 or all the equivalent SNPNs. Otherwise, the UE shall apply the timer T3585 for the registered PLMN or the registered SNPN. Additionally, if the 5GSM congestion re-attempt indicator IE with the CATBO bit set to "The back-off timer is applied in the current access type" is included in the PDU SESSION ESTABLISHMENT REJECT message with the 5GSM cause value #69 "insufficient resources for specific slice", then the UE shall apply the timer T3585 for the current access type. Otherwise, the UE shall apply the timer T3585 for both 3GPP access type and non-3GPP access type and the UE shall stop any running timer T3585 for the applied PLMN or SNPN and for the access different from the access from which the PDU SESSION ESTABLISHMENT REJECT message is received.

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 as specified in subclause 6.2.8.

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 (if any) remains the same and the entry in the "list of subscriber data" to which timer T3585 is associated (if any) is not updated, 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 (if any) remains the same and the entry in the "list of subscriber data" to which timer T3585 is associated (if any) is not updated 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.

NOTE: As described in this subclause, upon PLMN change, SNPN 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 or SNPN, the S-NSSAI and optionally the DNN combination when the UE returns to the PLMN or SNPN 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 or SNPN for the same S-NSSAI and optionally the same DNN.

Upon PLMN change or SNPN change, if T3584 applied for the registered PLMN or the registered SNPN is running or is deactivated for an S-NSSAI, a DNN, and old PLMN or old SNPN, but T3584 is not running and is not deactivated for

the S-NSSAI, the DNN, and new PLMN or new SNPN, 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 or new SNPN.

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

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

6.4.1.4.3 Handling of network rejection not due to congestion control

If the 5GSM cause value is different from #26 "insufficient resources", #28 "unknown PDU session type", #39 "reactivation requested", #46 "out of LADN service area", #50 "PDU session type IPv4 only allowed", #51 "PDU session type IPv6 only allowed", #54 "PDU session does not exist", #57 "PDU session type IPv4v6 only allowed", #58 "PDU session type Unstructured only allowed", #61 "PDU session type Ethernet only allowed", #67 "insufficient resources for specific slice and DNN", #68 "not supported SSC mode", and #69 "insufficient resources for specific slice", #86 "UAS services not allowed", and #33 "requested service option not subscribed" upon sending PDU SESSION ESTABLISHMENT REQUEST to establish an MA PDU session, and the Back-off timer value IE is included, the UE shall behave as follows: (if the UE is a UE configured for high priority access in selected PLMN or SNPN, exceptions are specified in subclause 6.2.12):

a) if the timer value indicates neither zero nor deactivated and:

   1) if the UE provided a DNN and S-NSSAI to the network during the PDU session establishment and the 5GSM cause value is different from #27 "missing or unknown DNN", the UE shall start the back-off timer with the value provided in the Back-off timer value IE for the PDU session establishment procedure and:

      i) in a PLMN, [PLMN, DNN, (mapped) HPLMN S-NSSAI] combination. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same DNN and (mapped) HPLMN S-NSSAI in the current PLMN, until the back-off timer expires, the UE is switched off, or the USIM is removed; or

      ii) in an SNPN, [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, (mapped) subscribed SNPN S-NSSAI] combination. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same DNN and (mapped) subscribed SNPN S-NSSAI in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the back-off timer expires, the UE is switched off, the USIM is removed, or the selected entry of the "list of subscriber data" is updated;

   2) if the UE provided a DNN to the network during the PDU session establishment and the 5GSM cause value is #27 "missing or unknown DNN", the UE shall start the back-off timer with the value provided in the Back-off timer value IE for the PDU session establishment procedure and:

      i) in a PLMN, [PLMN, DNN] combination. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same DNN in the current PLMN, until the back-off timer expires, the UE is switched off, or the USIM is removed; or

      ii) in an SNPN, [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN] combination. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same DNN in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the back-off timer expires, the UE is switched off, the USIM is removed, or the selected entry of the "list of subscriber data" is updated;

   3) if the UE did not provide a DNN or S-NSSAI or any of the two parameters to the network during the PDU session establishment and the 5GSM cause value is different from #27 "missing or unknown DNN", it shall start the back-off timer accordingly for the PDU session establishment procedure and:

      i) in a PLMN, [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, (mapped) HPLMN S-NSSAI] or [PLMN, no DNN, no S-NSSAI] combination. Dependent on the combination, the UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same [PLMN, DNN, no S-NSSAI], [PLMN,

no DNN, (mapped) HPLMN S-NSSAI] or [PLMN, no DNN, no S-NSSAI] combination in the current PLMN, until the back-off timer expires, the UE is switched off, or the USIM is removed; or

ii) in an SNPN, [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI] or [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] combination. Dependent on the combination, the UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI] or [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] combination in the current PLMN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the back-off timer expires, the UE is switched off, the USIM is removed or the selected entry of the "list of subscriber data" is updated; or

4) if the UE did not provide a DNN to the network during the PDU session establishment and the 5GSM cause value is #27 "missing or unknown DNN", it shall start the back-off timer accordingly for the PDU session establishment procedure and:

i) in a PLMN, [PLMN, no DNN] combination. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same [PLMN, no DNN] in the current PLMN, until the back-off timer expires, the UE is switched off, or the USIM is removed; or

ii) in an SNPN, [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN] combination. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN] in the current PLMN, using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the back-off timer expires, the UE is switched off, the USIM is removed or the selected entry of the "list of subscriber data" is updated;

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

1) if the UE provided a DNN and S-NSSAI to the network during the PDU session establishment and the 5GSM cause value is different from #27 "missing or unknown DNN", the UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for:

i) in a PLMN, the same DNN and (mapped) HPLMN S-NSSAI in the current PLMN, until the UE is switched off, or the USIM is removed; or

ii) in an SNPN, the same DNN and (mapped) subscribed SNPN S-NSSAI in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the UE is switched off, the USIM is removed, or the selected entry of the "list of subscriber data" is updated;

2) if the UE provided a DNN to the network during the PDU session establishment and the 5GSM cause value is #27 "missing or unknown DNN", the UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for:

i) in a PLMN, the same DNN in the current PLMN, until the UE is switched off, or the USIM is removed; or

ii) in an SNPN, the same DNN in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the UE is switched off, the USIM is removed, or the selected entry of the "list of subscriber data" is updated;

3) if the UE did not provide a DNN or S-NSSAI or any of the two parameters to the network during the PDU session establishment and the 5GSM cause value is different from #27 "missing or unknown DNN", the UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for:

i) in a PLMN, the same [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, (mapped) HPLMN S-NSSAI] or [PLMN, no DNN, no S-NSSAI] combination in the current PLMN, until the UE is switched off, or the USIM is removed; or

ii) in an SNPN, the same [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI] or [SNPN, the selected entry of the

"list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] combination in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the UE is switched off, the USIM is removed, or the selected entry of the "list of subscriber data" is updated; or

4) if the UE did not provide a DNN to the network during the PDU session establishment and the 5GSM cause value is #27 "missing or unknown DNN", the UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for:

i) in a PLMN, the same [PLMN, no DNN] in the current PLMN, until the UE is switched off, or the USIM is removed; or

ii) in an SNPN, the same [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN] in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the UE is switched off, the USIM is removed, or the selected entry of the "list of subscriber data" is updated; and

c) if the timer value indicates zero and the 5GSM cause value is different from #27 "missing or unknown DNN", the UE may send another PDU SESSION ESTABLISHMENT REQUEST message for:

1) in a PLMN, the same combination of [PLMN, DNN, (mapped) HPLMN S-NSSAI], [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, (mapped) HPLMN S-NSSAI], or [PLMN, no DNN, no S-NSSAI] in the current PLMN. If the timer value indicates zero and the 5GSM cause value is #27 "missing or unknown DNN", the UE may send another PDU SESSION ESTABLISHMENT REQUEST message for the same combination of [PLMN, DNN], or [PLMN, no DNN] in the current PLMN; or

2) in an SNPN, the same combination of [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, (mapped) subscribed SNPN S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed S-NSSAI], or [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription. If the timer value indicates zero and the 5GSM cause value is #27 "missing or unknown DNN", the UE may send another PDU SESSION ESTABLISHMENT REQUEST message for the same combination of [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN], or [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN] in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription.

If the Back-off timer value IE is not included, then the UE shall ignore the Re-attempt indicator IE provided by the network in the PDU SESSION ESTABLISHMENT REJECT message, if any.

a) Additionally, if the 5GSM cause value is #8 "operator determined barring", #32 "service option not supported", #33 "requested service option not subscribed" upon sending PDU SESSION ESTABLISHMENT REQUEST not to establish an MA PDU session, or #70 "missing or unknown DNN in a slice", then:

1) the UE not operating in SNPN access operation mode shall proceed as follows:

i) if the UE is registered in the HPLMN or in a PLMN that is within the EHPLMN list, the UE shall behave as described above in the present subclause using the configured SM Retry Timer value as specified in 3GPP TS 24.368 [17] or in USIM file NAS_{CONFIG} as specified in 3GPP TS 31.102 [22], if available, as back-off timer value; and

NOTE 1: The way to choose one of the configured SM Retry Timer values for back-off timer value is up to UE implementation if the UE is configured with:
- an SM Retry Timer value in ME as specified in 3GPP TS 24.368 [17]; and
- an SM Retry Timer value in USIM file NAS_{CONFIG} as specified in 3GPP TS 31.102 [22].

ii) otherwise, if the UE is not registered in its HPLMN or in a PLMN that is within the EHPLMN list, or if the SM Retry Timer value is not configured, the UE shall behave as described above in the present subclause, using the default value of 12 minutes for the back-off timer; or

2) the UE operating in SNPN access operation mode shall proceed as follows:

i) if:

A) the SM Retry Timer value for the current SNPN as specified in 3GPP TS 24.368 [17] is available; or

B) the UE used the USIM for registration to the current SNPN and the SM Retry Timer value in USIM file NAS_{CONFIG} as specified in 3GPP TS 31.102 [22] is available;

then the UE shall behave as described above in the present subclause using the configured SM Retry Timer value as back-off timer value; or

NOTE 2: The way to choose one of the configured SM Retry Timer values for back-off timer value is up to UE implementation if both conditions in bullets A) and B) above are satisfied.

ii) otherwise, the UE shall behave as described above in the present subclause, using the default value of 12 minutes for the back-off timer.

b) For 5GSM cause value #27 "missing or unknown DNN", then:

1) the UE not operating in SNPN access operation mode shall proceed as follows:

i) if the UE is registered in the HPLMN or in a PLMN that is within the EHPLMN list, the UE shall start the back-off timer with the configured SM Retry Timer value as specified in 3GPP TS 24.368 [17] or in USIM file NAS_{CONFIG} as specified in 3GPP TS 31.102 [22], if available, as back-off timer value for the PDU session establishment procedure and the [PLMN, DNN] or [PLMN, no DNN] combination. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same DNN in the current PLMN, until the back-off timer expires, the UE is switched off or the USIM is removed; and

NOTE 3: The way to choose one of the configured SM Retry Timer values for back-off timer value is up to UE implementation if the UE is configured with:
- an SM Retry Timer value in ME as specified in 3GPP TS 24.368 [17]; and
- an SM Retry Timer value in USIM file NAS_{CONFIG} as specified in 3GPP TS 31.102 [22].

ii) otherwise, if the UE is not registered in its HPLMN or in a PLMN that is within the EHPLMN list, or if the SM Retry Timer value is not configured, the UE shall start the back-off timer with the default value of 12 minutes as back-off timer value for the PDU session establishment procedure and the [PLMN, DNN] or [PLMN, no DNN] combination. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same DNN in the current PLMN, until the back-off timer expires, the UE is switched off or the USIM is removed; or

2) the UE operating in SNPN access operation mode shall proceed as follows:

i) if:

A) the SM Retry Timer value for the current SNPN as specified in 3GPP TS 24.368 [17] is available; or

B) the UE used the USIM for registration to the current SNPN and the SM Retry Timer value in USIM file NAS_{CONFIG} as specified in 3GPP TS 31.102 [22] is available;

then:

the UE shall start the back-off timer with the configured SM Retry Timer value as back-off timer value for the PDU session establishment procedure and the [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN] or [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN] combination. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message for the same DNN in the current SNPN using the selected entry in the "list of subscriber data" or selected PLMN subscription, until the back-off timer expires, the UE is switched off, the UICC containing the USIM is removed or the selected entry of the "list of subscriber data" is updated; or

NOTE 4: The way to choose one of the configured SM Retry Timer values for back-off timer value is up to UE implementation if both conditions in bullets A) and B) above are satisfied.

ii) otherwise:

- the UE shall start the back-off timer with the default value of 12 min as back-off timer value for the PDU session establishment procedure and the [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN] or [SNPN, selected entry in the "list of subscriber data" or selected PLMN subscription, no DNN] combination. The UE shall not send another PDU SESSION

ESTABLISHMENT REQUEST message for the same DNN in the current SNPN using the selected entry of the "list of subscriber data", until the back-off timer expires, the UE is switched off, the UICC containing the USIM is removed or the selected entry of the "list of subscriber data" is updated; and

c) For 5GSM cause values different from #8 "operator determined barring", #27 "missing or unknown DNN", #32 "service option not supported", #33 "requested service option not subscribed" and #70 "missing or unknown DNN in a slice", the UE behaviour regarding the start of a back-off timer is specified in subclause 6.2.12.

The UE shall not stop any back-off timer:

a) upon a PLMN or SNPN change;

b) upon an inter-system change; or

c) upon registration over another access type.

If the network indicates that a back-off timer for the PDU session establishment procedure is deactivated, then it remains deactivated;

a) upon a PLMN or SNPN change;

b) upon an inter-system change; or

c) upon registration over another access type.

NOTE 5: This means the back-off timer can still be running or be deactivated for the given 5GSM procedure when the UE returns to the PLMN or SNPN 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 message for the combination of [PLMN, DNN, (mapped) HPLMN S-NSSAI], [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, (mapped) HPLMN S-NSSAI], [PLMN, no DNN, no S-NSSAI], [PLMN, DNN], or [PLMN, no DNN] in the PLMN, or for the combination of [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, (mapped) subscribed S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN], or [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN] in the SNPN.

If the back-off timer is started upon receipt of a PDU SESSION ESTABLISHMENT REJECT (i.e. the timer value was provided by the network, a configured value is available or the default value is used as explained above) or the back-off timer is deactivated, the UE behaves as follows:

a) after a PLMN or SNPN change:

1) the UE may send a PDU SESSION ESTABLISHMENT REQUEST message for:

i) in a PLMN, the combination of [new PLMN, DNN, (mapped) HPLMN S-NSSAI], [new PLMN, DNN, no S-NSSAI], [new PLMN, no DNN, (mapped) HPLMN S-NSSAI], or [new PLMN, no DNN, no S-NSSAI] in the new PLMN, if the back-off timer is not running and is not deactivated for the PDU session establishment procedure and the combination of [new PLMN, DNN, (mapped) HPLMN S-NSSAI], [new PLMN, DNN, no S-NSSAI], [new PLMN, no DNN, (mapped) HPLMN S-NSSAI], or [new PLMN, no DNN, no S-NSSAI]; or

ii) in an SNPN, the combination of [new SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, (mapped) subscribed SNPN S-NSSAI], [new SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [new PLMN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI], or [new SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] in the new SNPN, if the back-off timer is not running and is not deactivated for the PDU session establishment procedure and the combination of [new SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, (mapped) subscribed SNPN S-NSSAI], [new SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [new SNPN, the selected entry of the "list of subscriber data" or

selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI], or [new SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI];

2) as an implementation option, for the 5GSM cause value #8 "operator determined barring", #32 "service option not supported", #33 "requested service option not subscribed" and #70 "missing or unknown DNN in a slice", if the network does not include a Re-attempt indicator IE, the UE may decide not to automatically send another PDU SESSION ESTABLISHMENT REQUEST message for:

   i) in a PLMN, the same combination of [PLMN, DNN, (mapped) HPLMN S-NSSAI], [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, (mapped) HPLMN S-NSSAI], or [PLMN, no DNN, no S-NSSAI] using the same PDU session type if the UE is registered to a new PLMN which is in the list of equivalent PLMNs; or

   ii) in an SNPN, if the UE supports equivalent SNPNs, the same combination of [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, (mapped) subscribed SNPN S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI], or [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] using the same PDU session type and using the selected entry of the "list of subscriber data" or selected PLMN subscription, if the UE is registered to a new SNPN which is in the list of equivalent SNPNs; and

3) as an implementation option, for the 5GSM cause value #27 "missing or unknown DNN", if the network does not include a Re-attempt indicator IE, the UE may decide not to automatically send another PDU SESSION ESTABLISHMENT REQUEST message for:

   i) in a PLMN, the same combination of [PLMN, DNN] or [PLMN, no DNN] using the same PDU session type if the UE is registered to a new PLMN which is in the list of equivalent PLMNs; or

   ii) in an SNPN, if the UE supports equivalent SNPNs, the same combination of [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN] or [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN] using the same PDU session type if the UE is registered to a new SNPN which is in the list of equivalent SNPNs; or

b) if the network does not include the Re-attempt indicator IE to indicate whether re-attempt in S1 mode is allowed, or the UE ignores the Re-attempt indicator IE, e.g. because the Back-off timer value IE is not included, then:

1) if the UE is registered in its HPLMN or in a PLMN that is within the EHPLMN list and the back-off timer is running for the combination of [PLMN, DNN, (mapped) HPLMN S-NSSAI] or [PLMN, DNN, no S-NSSAI], the UE shall apply the configured SM_RetryAtRATChange value as specified in 3GPP TS 24.368 [17] or in USIM file NAS_{CONFIG} as specified in 3GPP TS 31.102 [22], if available, to determine whether the UE may attempt a PDN connectivity procedure for the same [PLMN, DNN] combination in S1 mode. If the back-off timer is running for the combination of [PLMN, no DNN, (mapped) HPLMN S-NSSAI] or [PLMN, no DNN, no S-NSSAI], the same applies for the PDN connectivity procedure for the [PLMN, no DNN] combination in S1 mode accordingly; and

NOTE 6: The way to choose one of the configured SM_RetryAtRATChange values for back-off timer value is up to UE implementation if the UE is configured with:
- an SM_RetryAtRATChange value in ME as specified in 3GPP TS 24.368 [17]; and
- an SM_RetryAtRATChange value in USIM file NAS_{CONFIG} as specified in 3GPP TS 31.102 [22].

2) if the UE is not registered in its HPLMN or in a PLMN that is within the EHPLMN list, or if the NAS configuration MO as specified in 3GPP TS 24.368 [17] is not available and the value for inter-system change is not configured in the USIM file NAS_{CONFIG}, then the UE behaviour regarding a PDN connectivity procedure for the same [PLMN, DNN] or [PLMN, no DNN] combination in S1 mode is unspecified; and

c) if the network includes the Re-attempt indicator IE indicating that re-attempt in an equivalent PLMN or SNPN is not allowed, then depending on the timer value received in the Back-off timer value IE, for:

1) in a PLMN, each combination of a PLMN from the equivalent PLMN list and the respective [DNN, (mapped) HPLMN S-NSSAI], [DNN, no S-NSSAI], [no DNN, (mapped) HPLMN S-NSSAI], or [no DNN, no S-NSSAI] combination, the UE shall start a back-off timer for the PDU session establishment procedure with the value provided by the network, or deactivate the respective back-off timer as follows:

i) if the Re-attempt indicator IE additionally indicates that re-attempt in S1 mode is allowed, the UE shall start or deactivate the back-off timer for N1 mode only; and

ii) otherwise, the UE shall start or deactivate the back-off timer for S1 and N1 mode; or

2) in a SNPN, if the UE supports equivalent SNPNs, each combination of a SNPN from the equivalent SNPN list and the respective [the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, (mapped) subscribed SNPN S-NSSAI], [the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI], or [the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] combination, the UE shall start a back-off timer for the PDU session establishment procedure with the value provided by the network, or deactivate the respective back-off timer, for N1 mode.

If the back-off timer for a [PLMN, DNN] or [PLMN, no DNN] combination, was started or deactivated in S1 mode upon receipt of PDN CONNECTIVITY REJECT message (see 3GPP TS 24.301 [15]) and the network indicated that re-attempt in N1 mode is allowed, then this back-off timer does not prevent the UE from sending a PDU SESSION ESTABLISHMENT REQUEST message in this PLMN for the same DNN, or without DNN, after inter-system change to N1 mode. If the network indicated that re-attempt in N1 mode is not allowed, the UE shall not send any PDU SESSION ESTABLISHMENT REQUEST message in this PLMN for the same DNN in combination with any S-NSSAI or without S-NSSAI, or in this PLMN without DNN in combination with any S-NSSAI or without S-NSSAI, after inter-system change to N1 mode until the timer expires, the UE is switched off or the USIM is removed.

NOTE 7: The back-off timer is used to describe a logical model of the required UE behaviour. This model does not imply any specific implementation, e.g. as a timer or timestamp.

NOTE 8: Reference to back-off timer in this section can either refer to use of timer T3396 or to use of a different packet system specific timer within the UE. Whether the UE uses T3396 as a back-off timer or it uses different packet system specific timers as back-off timers is left up to UE implementation.

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

If the 5GSM cause value is #28 "unknown PDU session type" and the PDU SESSION ESTABLISHMENT REQUEST message contained a PDU session type IE indicating a PDU session type, the UE shall ignore the Back-off timer value IE and Re-attempt indicator IE provided by the network, if any. The UE may send another PDU SESSION ESTABLISHMENT REQUEST message to establish a new PDU session with the PDU session type IE indicating another PDU session type, e.g. using another value which can be used for the rejected component in another route selection descriptor, if any, as specified in 3GPP TS 24.526 [19]. The behaviour of the UE for 5GSM cause value #28 also applies if the PDU session is a MA PDU Session.

If the 5GSM cause value is #39 "reactivation requested", the UE shall ignore the Back-off timer value IE and Re-attempt indicator IE provided by the network, if any.

NOTE 9: Further UE behaviour upon receipt of 5GSM cause value #39 is up to the UE implementation.

If the 5GSM cause value is #46 "out of LADN service area", the UE shall ignore the Back-off timer value IE and Re-attempt indicator IE provided by the network, if any. If the UE is not located inside the LADN service area, the UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message or another PDU SESSION MODIFICATION REQUEST message except for indicating a change of 3GPP PS data off UE status for the LADN DNN provided by the UE during the PDU session establishment procedure until the LADN information for the specific LADN DNN or the extended LADN information for the specific LADN DNN and S-NSSAI is updated as described in subclause 5.4.4 and subclause 5.5.1. If the UE is not located inside the LADN service area, the UE shall not indicate the PDU session(s) for the LADN DNN provided by the UE during the PDU session establishment procedure in the Uplink data status IE included in the SERVICE REQUEST message until the LADN information for the specific LADN DNN or the extended LADN information for the specific LADN DNN and S-NSSAI is updated as described in subclause 5.4.4 and subclause 5.5.1.

NOTE 10: Based on UE implementation, the UE locating inside the LADN service area can send another PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST message for the LADN DNN which was rejected with the 5GSM cause value #46 "out of LADN service area".

NOTE 10A: If the UE does not receive a CONFIGURATION UPDATE COMMAND message with new LADN information within an implementation dependent time, the UE can request this information by initiating a registration procedure for mobility or periodic registration update (see subclause 5.5.1.3.2, item q).

If the 5GSM cause value is #50 "PDU session type IPv4 only allowed", #51 "PDU session type IPv6 only allowed", #57 "PDU session type IPv4v6 only allowed", #58 "PDU session type Unstructured only allowed", or #61 "PDU session type Ethernet only allowed", the UE shall ignore the Back-off timer value IE provided by the network, if any. The UE shall evaluate the URSP rules if available as specified in 3GPP TS 24.526 [19]. The UE shall not subsequently send another PDU SESSION ESTABLISHMENT REQUEST message for:

a) in a PLMN, the same DNN (or no DNN, if no DNN was indicated by the UE) and the same (mapped) HPLMN S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE) to obtain a PDU session type different from the one allowed by the network until any of the following conditions is fulfilled:

   1) the UE is registered to a new PLMN which was not in the list of equivalent PLMNs at the time when the PDU SESSION ESTABLISHMENT REJECT message was received;

   2) the UE is registered to a new PLMN which was in the list of equivalent PLMNs at the time when the PDU SESSION ESTABLISHMENT REJECT message was received, and either the network did not include a Re-attempt indicator IE in the PDU SESSION ESTABLISHMENT REJECT message or the Re-attempt indicator IE included in the message indicated that re-attempt in an equivalent PLMN is allowed;

   3) the UE is switched off; or

   4) the USIM is removed; or

b) in an SNPN, the same DNN (or no DNN, if no DNN was indicated by the UE) and the same (mapped) subscribed SNPN S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE), using the selected entry of the "list of subscriber data" or selected PLMN subscription until any of the following conditions is fulfilled:

   1) the UE is registered to a new SNPN which was not in the list of equivalent SNPNs at the time when the PDU SESSION ESTABLISHMENT REJECT message was received;

   2) the UE is registered to a new SNPN which was in the list of equivalent SNPNs at the time when the PDU SESSION ESTABLISHMENT REJECT message was received, and either the network did not include a Re-attempt indicator IE in the PDU SESSION ESTABLISHMENT REJECT message or the Re-attempt indicator IE included in the message indicated that re-attempt in an equivalent SNPN is allowed;

   3) the UE is switched off;

   4) the USIM is removed; or

   5) the selected entry of the "list of subscriber data" is updated.

For the 5GSM cause values #50 "PDU session type IPv4 only allowed", #51 "PDU session type IPv6 only allowed", #57 "PDU session type IPv4v6 only allowed", #58 "PDU session type Unstructured only allowed", and #61 "PDU session type Ethernet only allowed", the UE shall ignore the value of the RATC bit in the Re-attempt indicator IE provided by the network, if any.

NOTE 11: For the 5GSM cause values #50 "PDU session type IPv4 only allowed", #51 "PDU session type IPv6 only allowed", #57 "PDU session type IPv4v6 only allowed", #58 "PDU session type Unstructured only allowed", and #61 "PDU session type Ethernet only allowed", re-attempt in S1 mode for the same DNN (or no DNN, if no DNN was indicated by the UE) is only allowed using the PDU session type(s) indicated by the network.

If the 5GSM cause value is #54 "PDU session does not exist", the UE shall ignore the Back-off timer value IE and Re-attempt indicator IE provided by the network, if any. If the PDU session establishment procedure is to perform handover of an existing PDU session between 3GPP access and non-3GPP access, the UE shall release locally the existing PDU session with the PDU session ID included in the PDU SESSION ESTABLISHMENT REJECT message. The UE may initiate another UE-requested PDU session establishment procedure with the request type set to "initial request" in the subsequent PDU SESSION ESTABLISHMENT REQUEST message to establish a PDU session with:

a) in a PLMN, the same DNN (or no DNN, if no DNN was indicated by the UE) and the same (mapped) HPLMN S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE); or

b) in an SNPN, the same DNN (or no DNN, if no DNN was indicated by the UE) and the same (mapped) subscribed SNPN S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE) using the selected entry of the "list of subscriber data" or selected PLMN subscription.

NOTE 12: User interaction is necessary in some cases when the UE cannot re-establish the PDU session(s) automatically.

If the 5GSM cause value is #68 "not supported SSC mode", the UE shall ignore the Back-off timer value IE and Re-attempt indicator IE provided by the network, if any. The UE shall evaluate the URSP rules if available as specified in 3GPP TS 24.526 [19]. The UE shall not subsequently send another PDU SESSION ESTABLISHMENT REQUEST message for:

a) in a PLMN, the same DNN (or no DNN, if no DNN was indicated by the UE) and the same (mapped) HPLMN S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE) using the same SSC mode or an SSC mode which was not included in the Allowed SSC mode IE until any of the following conditions is fulfilled:

   1) the UE is registered to a new PLMN which was not in the list of equivalent PLMNs at the time when the PDU SESSION ESTABLISHMENT REJECT message was received;

   2) the SSC mode which is used to access to the DNN (or no DNN, if no DNN was indicated by the UE) and the (mapped) HPLMN S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE) is changed by the UE which subsequently requests a new SSC mode in the Allowed SSC mode IE or no SSC mode;

   3) the UE is switched off; or

   4) the USIM is removed; or

b) in an SNPN, the same DNN (or no DNN, if no DNN was indicated by the UE) and the same subscribed SNPN S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE) using the same SSC mode or an SSC mode which was not included in the Allowed SSC mode IE, using the selected entry of the "list of subscriber data" or selected PLMN subscription until any of the following conditions is fulfilled:

   1) the UE is registered to a new SNPN which was not in the list of equivalent SNPNs at the time when the PDU SESSION ESTABLISHMENT REJECT message was received;

   2) the SSC mode which is used to access to the DNN (or no DNN, if no DNN was indicated by the UE) and the (mapped) subscribed SNPN S-NSSAI (or no S-NSSAI, if no S-NSSAI was indicated by the UE) is changed by the UE which subsequently requests a new SSC mode in the Allowed SSC mode IE or no SSC mode;

   3) the UE is switched off;

   4) the USIM is removed, or

   5) the selected entry of the "list of subscriber data" is updated.

If the UE receives the 5GSM cause value is #33 "requested service option not subscribed" upon sending PDU SESSION ESTABLISHMENT REQUEST to establish an MA PDU session, the UE shall ignore the Back-off timer value IE and Re-attempt indicator IE provided by the network, if any. The UE shall evaluate URSP rules, if available, as specified in 3GPP TS 24.526 [19] and the UE may send PDU SESSION ESTABLISHMENT REQUEST after evaluating those URSP rules.

If the 5GSM cause value is #86 "UAS services not allowed", the UE shall ignore the Back-off timer value IE and Re-attempt indicator IE provided by the network, if any, and shall behave as specified in subcluase 6.4.1.4.1.

Upon receipt of an indication from 5GMM sublayer that the 5GSM message was not forwarded because the DNN is not supported or not subscribed in a slice along with a PDU SESSION ESTABLISHMENT REQUEST message with the PDU session ID IE set to the PDU session ID of the PDU session, the UE shall stop timer T3580, shall abort the procedure and shall behave as follows:

a) if the timer value indicates neither zero nor deactivated, the UE shall start the back-off timer with the value received from the 5GMM sublayer for the PDU session establishment procedure and:

   1) in a PLMN, the [PLMN, DNN, S-NSSAI] combination or the [PLMN, DNN, no S-NSSAI] combination, if no S-NSSAI was provided during the PDU session establishment. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message in the PLMN for the same DNN and the same S-NSSAI

that were sent by the UE, or for the same DNN and no S-NSSAI if S-NSSAI that was not sent by the UE, until:

i) the back-off timer expires;

ii) the UE is switched off;

iii) the USIM is removed; or

iv) the DNN is included in the LADN information or extended LADN information and the network provides the LADN information or extended LADN information during the registration procedure or the generic UE configuration update procedure; or

2) in an SNPN, the [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, S-NSSAI] combination or the [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI] combination, if no S-NSSAI was provided during the PDU session establishment. The UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message in the SNPN for the same DNN and the same S-NSSAI that were sent by the UE, or for the same DNN and no S-NSSAI if S-NSSAI that was not sent by the UE, using the selected entry of the "list of subscriber data" or selected PLMN subscription, until:

i) the back-off timer expires;

ii) the UE is switched off;

iii) the USIM is removed; or

iv) the selected entry of the "list of subscriber data" is updated; or

v) the DNN is included in the LADN information or extended LADN information and the network provides the LADN information or extended LADN information during the registration procedure or the generic UE configuration update procedure;

b) if the timer value is not received from the 5GMM sublayer or the timer value indicates that this timer is deactivated, the UE shall not send another PDU SESSION ESTABLISHMENT REQUEST message

1) in the PLMN for the same DNN and the same S-NSSAI that were sent by the UE, or for the same DNN and no S-NSSAI if S-NSSAI that was not sent by the UE, until:

i) the UE is switched off;

ii) the USIM is removed; or

iii) the DNN is included in the LADN information or extended LADN information and the network provides the LADN information or extended LADN information during the registration procedure or the generic UE configuration update procedure; and

2) in the SNPN, for the same DNN and the same S-NSSAI that were sent by the UE, or for the same DNN and no S-NSSAI if S-NSSAI that was not sent by the UE, using the selected entry of the "list of subscriber data" or selected PLMN subscription, until:

i) the UE is switched off;

ii) the USIM is removed;

iii) the selected entry of the "list of subscriber data" is updated; or

iii) the DNN is included in the LADN information or extended LADN information and the network provides the LADN information or extended LADN information during the registration procedure or the generic UE configuration update procedure; and

c) if the timer value indicates zero, the UE may send another PDU SESSION ESTABLISHMENT REQUEST message for:

1) in a PLMN, the same combination of [PLMN, DNN, S-NSSAI], [PLMN, DNN, no S-NSSAI] in the current PLMN; or

2) in an SNPN, the same combination of [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI] in the current SNPN.

6.4.1.5 Handling the maximum number of established PDU sessions

The maximum number of PDU sessions which a UE can establish in a PLMN or SNPN is limited by whichever is the lowest of: the maximum number of PDU session IDs allowed by the protocol (as specified in 3GPP TS 24.007 [11] subclause 11.2.3.1b), the PLMN's or SNPN's maximum number of PDU sessions and the UE's implementation-specific maximum number of PDU sessions.

If during a UE-requested PDU session establishment procedure the 5GSM sublayer in the UE receives an indication that the 5GSM message was not forwarded because:

a) the PLMN's maximum number of PDU sessions has been reached, then the UE determines the PLMN's maximum number of PDU sessions as the number of active PDU sessions it has; or

b) the SNPN's maximum number of PDU sessions has been reached, then the UE determines the SNPN's maximum number of PDU sessions as the number of active PDU sessions it has and associates the determined maximum number of PDU sessions with:

   1) the entry in the "list of subscriber data" for the current SNPN if the UE does not support access to an SNPN using credentials from a credentials holder and equivalent SNPNs; or

   2) the selected entry of the "list of subscriber data" or the selected PLMN subscription if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both.

NOTE 1: In some situations, when attempting to establish multiple PDU sessions, the number of active PDU sessions that the UE has when 5GMM cause #65 is received is not equal to the maximum number of PDU sessions reached in the network.

NOTE 2: When the network supports emergency services, it is not expected that 5GMM cause #65 is returned by the network when the UE requests an emergency PDU session.

NOTE 3: The network maintains only one maximum number of PDU sessions for a PLMN regardless of which access the PDU session exists in.

NOTE 3a: When the UE is registered on the same PLMN for both 3GPP access and non-3GPP access, the UE maintains single maximum number of PDU sessions for respective PLMN. When the UE is registered on two different PLMNs over 3GPP access and non-3GPP access, the UE maintains maximum number of PDU sessions for a PLMN separately for each PLMN.

NOTE 4: An MA PDU session which (only) has a PDN connection established as a user-plane resource is counted as an active PDU session when determining the PLMN's maximum number of PDU sessions.

The PLMN's maximum number of PDU sessions applies to the PLMN in which the 5GMM cause #65 "maximum number of PDU sessions reached" is received. When the UE is switched off or when the USIM is removed, the UE shall clear all previous determinations representing PLMN's maximum number of PDU sessions.

The SNPN's maximum number of PDU sessions applies to the SNPN in which the 5GMM cause #65 "maximum number of PDU sessions reached" is received. When the UE is switched off, the UE shall clear all previous determinations representing SNPN's maximum number of PDU sessions. In addition:

a) if the UE does not support access to an SNPN using credentials from a credentials holder and equivalent SNPNs, and the entry in the "list of subscriber data" for the current SNPN is updated, then the UE shall clear all previous determinations representing SNPN's maximum number of PDU sessions associated with the entry in the "list of subscriber data" for the current SNPN; and

b) if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, and:

   1) the selected entry of the "list of subscriber data" is updated, then UE shall clear all previous determinations representing SNPN's maximum number of PDU sessions associated with the selected entry in the "list of subscriber data"; or

2) the USIM associated with the selected PLMN subscription is removed, then UE shall clear all previous determinations representing SNPN's maximum number of PDU sessions associated with the selected PLMN subscription.

Upon successful registration with a new PLMN or SNPN, the UE may clear previous determinations representing any PLMN's or SNPN's maximum number(s) of PDU sessions, if the previous PLMN or SNPN is not registered over both 3GPP access and non-3GPP access.

If the maximum number of established PDU sessions is reached at the UE and the upper layers of the UE request connectivity to a DNN the UE shall not send a PDU SESSION ESTABLISHMENT REQUEST message unless an established PDU session is released. If the UE needs to release an established PDU session, choosing which PDU session to release is implementation specific, however the UE shall not release the emergency PDU session.

If the UE needs to release a PDU session in order to request an emergency PDU session, it shall either perform a local release of a PDU session or release a PDU session via explicit signalling. If the UE performs a local release, the UE shall:

a) if the PDU session is an MA PDU session:

1) perform a registration procedure for mobility and periodic registration update to indicate PDU session status to the network over each access that user plane resources have been established; and

2) perform a normal and periodic tracking area updating to indicate EPS bearer context status to the network as specified in subclause 5.5.3.2.2 of 3GPP TS 24.301 [15] when a PDN connection has been established as a user plance resource; or

b) if the PDU session is a single access PDU session, perform a registration procedure for mobility and periodic registration update to indicate PDU session status to the network over the access the PDU session is associated with.

6.4.1.5A Handling the maximum number of allowed active user-plane resources for PDU sessions of UEs in NB-N1 mode

For a UE in NB-N1 mode, the UE's maximum number of supported user-plane resources is two (as defined in 3GPP TS 36.300 [25B]) when the UE sets the Multiple user-plane resources support bit to "Multiple user-plane resources supported" during the registration procedure for initial registration or for mobility and periodic registration update, and one otherwise.

For a UE operating in NB-N1 mode, if:

a) the UE's maximum number of supported user-plane resources is one, then only one PDU session can have active user-plane resources even though that UE might have established more than one PDU session; or

b) the UE's maximum number of supported user-plane resources is two, then only two PDU sessions can have active user-plane resources even though that UE might have established more than two PDU sessions.

When the maximum number of active user-plane resources is reached and upper layers request for more user-plane resources for PDU sessions other than the PDU sessions with those active user-plane resources, the UE can choose to release one or more of the PDU sessions with active user-plane resources to cater for the upper layer request. The choice of which PDU sessions to be released is implementation specific. However if there is a PDU session with an active user-plane that is used for exception data reporting (see subclause 6.2.13), that PDU session shall not be released.

If the maximum number of active user-plane resources is reached and the upper layers of the UE request user-plane resources for exception data reporting (see subclause 6.2.13), the UE shall release a PDU session that has user-plane resources to cater for the request for exception data reporting. The choice of which PDU session to be released is implementation specific.

If the UE decides to release one or more active user-plane resources to cater for upper layer request, the UE shall release the PDU session via explicit 5GSM signalling.

6.4.1.6 Abnormal cases in the UE

The following abnormal cases can be identified:

a) Expiry of timer T3580

The UE shall, on the first expiry of the timer T3580:

- if the PDU SESSION ESTABLISHMENT REQUEST message was sent with request type set to "initial emergency request" or "existing emergency PDU session", then the UE may:

  a) inform the upper layers of the failure of the procedure; or

NOTE 1: This can result in the upper layers requesting another emergency call attempt using domain selection as specified in 3GPP TS 23.167 [6].

  b) de-register locally, if not de-registered already, attempt initial registration for emergency services.

  If the UE sent the PDU SESSION ESTABLISHMENT REQUEST message in order to perform a handover of an existing emergency PDU session between 3GPP access and non-3GPP access, the UE shall consider that the emergency PDU session is associated with the source access type.

- otherwise, retransmit the PDU SESSION ESTABLISHMENT REQUEST message and the PDU session information which was transported together with the initial transmission of the PDU SESSION ESTABLISHMENT REQUEST message and shall reset and start timer T3580, if still needed. This retransmission can be repeated up to four times, i.e. on the fifth expiry of timer T3580, the UE shall abort the procedure, release the allocated PTI and enter the state PROCEDURE TRANSACTION INACTIVE. If the UE sent the PDU SESSION ESTABLISHMENT REQUEST message in order to perform a handover of an existing non-emergency PDU session between 3GPP access and non-3GPP access, the UE shall consider that the PDU session is associated with the source access type.

b) Upon receiving an indication that the 5GSM message was not forwarded due to routing failure along with a PDU SESSION ESTABLISHMENT REQUEST message with the PDU session ID IE set to the same value as the PDU session ID that was sent by the UE, the UE shall stop timer T3580 and shall abort the procedure. If the UE sent the PDU SESSION ESTABLISHMENT REQUEST message in order to perform a handover of an existing PDU session between 3GPP access and non-3GPP access, the UE shall consider that the PDU session is associated with the source access type.

b1) Upon receiving an indication that the 5GSM message was not forwarded due to service area restrictions along with a PDU SESSION ESTABLISHMENT REQUEST message with the PDU session ID IE set to the same value as the PDU session ID that was sent by the UE, the UE shall stop timer T3580 and shall abort the procedure. If the UE sent the PDU SESSION ESTABLISHMENT REQUEST message in order to perform a handover of an existing PDU session between 3GPP access and non-3GPP access, the UE shall consider that the PDU session is associated with the source access type.

b2) Upon receiving an indication that the 5GSM message was not forwarded because the UE is registered to a PLMN via a satellite NG-RAN cell that is not allowed to operate at the present UE location along with a PDU SESSION ESTABLISHMENT REQUEST message with the PDU session ID IE set to the same value as the PDU session ID that was sent by the UE, the UE shall stop timer T3580 and shall abort the procedure.

b3) Upon receiving an indication that the 5GSM message was not forwarded because the UE is marked in the UE's 5GMM context that it is not allowed to request UAS services along with a PDU SESSION ESTABLISHMENT REQUEST message with the PDU session ID IE set to the same value as the PDU session ID that was sent by the UE, the UE shall stop timer T3580 and shall abort the procedure. The UE shall not trigger the PDU session establishment procedure until the UE is deregistered from the PLMN.

b4) Upon receiving an indication that the 5GSM message was not forwarded because the PLMN's maximum number of PDU sessions has been reached along with a PDU SESSION ESTABLISHMENT REQUEST message with the PDU session ID IE set to the same value as the PDU session ID that was sent by the UE, the UE shall stop timer T3580 and shall abort the procedure.

b5) Upon receiving an indication that the 5GSM message was not forwarded due to unexpected cause along with a PDU SESSION ESTABLISHMENT REQUEST message with the PDU session ID IE set to the same value as the PDU session ID that was sent by the UE, the UE shall stop timer T3580 and shall abort the procedure.

c) Collision of UE-requested PDU session establishment procedure and network-requested PDU session release procedure.

If the UE receives a PDU SESSION RELEASE COMMAND message after sending a PDU SESSION ESTABLISHMENT REQUEST message to the network, and the PDU session ID in the PDU SESSION RELEASE COMMAND message is the same as the PDU session ID in the PDU SESSION ESTABLISHMENT REQUEST message:

i) if the UE-requested PDU session establishment procedure was to request the establishment of user plane resources on the second access for an MA PDU session established on a first access and the Access type IE is not included in PDU SESSION RELEASE COMMAND or the Access type IE included in PDU SESSION RELEASE COMMAND indicates the first access, the UE shall proceed with the network-requested PDU session release procedure, abort the UE-requested PDU session establishment procedure, stop timer T3580, release the allocated PTI and enter the state PROCEDURE TRANSACTION INACTIVE;

ii) if the PDU SESSION ESTABLISHMENT REQUEST message was sent with request type set to "existing PDU session" or "existing emergency PDU session" in order to perform a handover of an existing PDU session between 3GPP access and non-3GPP access, the UE shall abort the PDU session establishment procedure and proceed with the network-requested PDU session release procedure; or

iii) otherwise, the UE shall ignore the PDU SESSION RELEASE COMMAND message and proceed with the UE-requested PDU session establishment procedure.

d) Inter-system change from N1 mode to S1 mode triggered during UE-requested PDU session establishment procedure.

If the UE-requested PDU session establishment procedure is triggered for handover of an existing PDU session from non-3GPP access to 3GPP access, and the inter-system change from N1 mode to S1 mode is triggered by the NG-RAN and the UE did not receive response to PDU session establishment request, then the UE shall abort the procedure, stop timer T3580, and notify the upper layer of the handover failure.

NOTE 2: This can result in the upper layer requesting re-initiation of handover from non-3GPP access to 3GPP access after the inter-system change is completed, if still required.

e) For an MA PDU session established on a single access, upon receipt of a PDU SESSION ESTABLISHMENT ACCEPT message over the other access, if any value of the selected PDU session type, selected SSC mode, 5GSM cause, PDU address, S-NSSAI, DNN IEs in the PDU SESSION ESTABLISHMENT ACCEPT message is different from the corresponding stored value, the UE shall perform a local release of the MA PDU session, and perform the registration procedure for mobility and periodic registration update with a REGISTRATION REQUEST message including the PDU session status IE over both accesses.

f) For an MA PDU session has a PDN connection as a user-plane resource, upon receipt of a PDU SESSION ESTABLISHMENT ACCEPT message over non-3GPP access, if any value of the selected PDU session type, selected SSC mode, 5GSM cause, PDU address, S-NSSAI, DNN IEs in the PDU SESSION ESTABLISHMENT ACCEPT message is different from the corresponding stored mapped value, the UE shall perform a local release of the MA PDU session, perform the registration procedure for mobility and periodic registration update with a REGISTRATION REQUEST message including the PDU session status IE over non-3GPP access, and perform the tracking area updating procedure as specified in subclause 5.5.3.2.2 of 3GPP TS 24.301 [15] with a TRACKING AREA UPDATE REQUEST message including EPS bearer context status IE.

g) Collision of UE-requested PDU session establishment procedure initiated to perform handover of an existing PDU session from non-3GPP access to 3GPP access and a notification from the network with access type indicating non-3GPP access.

If the UE receives a notification from the network with access type indicating non-3GPP access after sending a PDU SESSION ESTABLISHMENT REQUEST message to perform handover of an existing PDU session from non-3GPP access to 3GPP access, the UE shall abort the PDU session establishment procedure, stop timer T3580, proceed with the service request procedure to perform handover of existing PDU session(s) from non-3GPP access to 3GPP access.

h) Collision of UE-requested PDU session establishment procedure and N1 NAS signalling connection release

The UE may immediately retransmit the PDU SESSION ESTABLISHMENT REQUEST message and stop, reset and restart timer T3580, if the following conditions apply:

1) The original UE-requested PDU session establishment procedure was initiated over an existing N1 NAS signalling connection;

2) the previous transmission of the PDU SESSION ESTABLISHMENT REQUEST message was not initiated due to timer T3580 expiry; and

3) no 5GSM message related to the PDU session (e.g. PDU SESSION AUTHENTICATION COMMAND message) was received after the PDU SESSION ESTABLISHMENT REQUEST message was transmitted.

i) Collision of UE-requested PDU session establishment procedure and network-requested PDU session modification procedure

If the UE receives a PDU SESSION MODIFICATION COMMAND message after sending a PDU SESSION ESTABLISHMENT REQUEST message to the network, and the PDU session ID in the PDU SESSION MODIFICATION COMMAND message is the same as the PDU session ID in the PDU SESSION ESTABLISHMENT REQUEST message:

i) if the UE-requested PDU session establishment procedure was to request the establishment of user plane resources on the second access for an MA PDU session established on a first access, the UE shall proceed with both the UE-requested PDU session establishment procedure and the network-requested PDU session modification procedure; or

ii) if the PDU SESSION ESTABLISHMENT REQUEST message was sent with request type set to "existing PDU session" or "existing emergency PDU session" in order to perform a handover of an existing PDU session between 3GPP access and non-3GPP access, the UE shall proceed with the UE-requested PDU session establishment procedure and abort the network-requested PDU session modification procedure.

6.4.1.7 Abnormal cases on the network side

The following abnormal cases can be identified:

a) If the received request type is "initial emergency request" and there is an existing emergency PDU session for the UE, regardless whether the PDU session ID in the PDU SESSION ESTABLISHMENT REQUEST message is identical to the PDU session ID of the existing PDU session, the SMF shall locally release the existing emergency PDU session and proceed the new PDU SESSION ESTABLISHMENT REQUEST message

b) The information for the PDU session authentication and authorization by the external DN in the SM PDU DN request container IE is not compliant with local policy and user's subscription data

If the PDU session being established is a non-emergency PDU session, the request type is not set to "existing PDU session", the PDU session authentication and authorization by the external DN is required due to local policy and user's subscription data and the information for the PDU session authentication and authorization by the external DN in the SM PDU DN request container IE is not compliant with the local policy and user's subscription data, the SMF shall reject the PDU session establishment request including the 5GSM cause #29 "user authentication or authorization failed", in the PDU SESSION ESTABLISHMENT REJECT message.

c) UE-requested PDU session establishment with request type set to "initial request" for an existing PDU session:

If the SMF receives a PDU SESSION ESTABLISHMENT REQUEST message with a PDU session ID identical to the PDU session ID of an existing PDU session and with request type set to "initial request", the SMF shall locally release the existing PDU session and proceed with the PDU session establishment procedure.

d) UE-requested PDU session establishment with request type "existing PDU session" or "existing emergency PDU session" for a PDU session that does not exist:

If the SMF receives a PDU SESSION ESTABLISHMENT REQUEST message with request type set to "existing PDU session" or "existing emergency PDU session", and the SMF does not have any information about that PDU session, then the SMF shall reject the PDU session establishment procedure with the 5GSM cause set to #54 "PDU session does not exist" in the PDU SESSION ESTABLISHMENT REJECT message.

e) 5G access network cannot forward the message:

If the SMF determines based on content of the n2SmInfo attribute specified in 3GPP TS 29.502 [20A] that the DL NAS TRANSPORT message carrying the PDU SESSION ESTABLISHMENT ACCEPT was not forwarded to the UE by the 5G access network, then the SMF shall reject the PDU session establishment procedure with the 5GSM cause set to #26 "insufficient resources" in the PDU SESSION ESTABLISHMENT REJECT message.

f) UE-requested MA PDU session establishment with unspecified steering functionality and steering mode:

If the SMF receives the PDU SESSION ESTABLISHMENT REQUEST message for an MA PDU session including the 5GSM capability information element that does not indicate support for any steering functionality or steering mode, the SMF shall reject the PDU session establishment procedure with the 5GSM cause set to #95 "Semantically incorrect message" in the PDU SESSION ESTABLISHMENT REJECT message.

6.4.2 UE-requested PDU session modification procedure

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 an 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 has not previously successfully performed the UE-requested PDU session modification to indicate to the network the relevant 5GSM parameters and capabilities;

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

g) to convey a port management information container;

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

i) to enable the UE to request to join or leave one or more multicast MBS sessions associated with a PDU session.

j) to send the URSP rule enforcement report to the network associated to:

1) an established PDU session; or

2) a PDN connection, after an 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.

NOTE 1: The case c), d), e), f) and g) do not apply to PDU sessions associated with the control plane only indication.

NOTE 2: For case e), the procedure is attempted after the first inter-system change from S1 mode to N1 mode.

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 an inter-system change from S1 mode to N1 mode, the UE is a UE operating in single-registration mode in the network

supporting N26 interface, the UE has not previously successfully performed the UE-requested PDU session modification to indicate to the network the relevant 5GSM parameters and capabilities, and:

a) 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; or

b) the UE is in substate 5GMM-REGISTERED.NON-ALLOWED-SERVICE and has not performed the the UE-requested PDU session modification procedure (see subclause 5.3.5), the UE shall initiate the UE-requested PDU session modification procedure after entering substate 5GMM-REGISTERED.NORMAL-SERVICE.

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 a procedure initiated according to subclause 6.4.2.1, item e) only, and 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 and the PDU session is not associated with the control plane only indication, 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 Requested 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 are specified in the Requested 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 Requested 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.

If the UE requests to join or leave one or more multicast MBS sessions associated with a PDU session, the UE shall include the Requested MBS container IE in the PDU SESSION MODIFICATION REQUEST message and shall set the MBS operation to "Join multicast MBS session" for the join case or to "Leave MBS session" for the leave case. The UE shall include the multicast MBS session information(s) and shall set the Type of multicast MBS session ID for each of the multicast MBS session information to either "Temporary Mobile Group Identity (TMGI)" or "Source specific IP multicast address" depending on the type of the multicast MBS session ID available in the UE. Then the remaining values of each of the multicast MBS session informations shall be set as following:

a) if the Type of multicast MBS session ID is set to "Temporary Mobile Group Identity (TMGI)", the UE shall set the multicast MBS session ID to the TMGI; or

b) if the Type of multicast MBS session ID is set to "Source specific IP multicast address for IPv4" or " Source specific IP multicast address for IPv6", the UE shall set the Source IP address information and the Destination IP address information to the corresponding values.

The UE should not request to join a multicast MBS session for local MBS service if neither current TAI nor CGI of the current cell is part of the MBS service area(s) of the multicast MBS session, if the UE has valid information of the MBS service area(s) of the multicast MBS session.

NOTE 1: The UE obtains the details of the multicast MBS session ID(s) e.g,TMGI, Source IP address information and Destination IP address information as a pre-configuration in the UE or during the MBS service announcement which is out of scope of this specification. Pre-configuration can be provided in one or more of the following ways:

a) in a UE implementation-specific way (e.g. factory configuration);

b) in the USIM (see $EF_{5MBSUECONFIG}$ file in 3GPP TS 31.102 [22]); or

c) in the UE pre-configuration MO for MBS (see 3GPP TS 24.575 [65]).

For a PDN connection established when in S1 mode, after an 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, the PDU session is not associated with the control plane only indication:

a) the UE is performing the PDU session modification procedure to indicate the support of reflective QoS and the UE has not previously successfully performed the UE-requested PDU session modification to provide this indication, 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 and the UE has not previously successfully performed the UE-requested PDU session modification to provide this indication, 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 and the PDU session is not associated with the control plane only indication, 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 2: 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 an 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, the PDU session is not associated with the control plane only indication:

a) the UE is performing the PDU session modification procedure to indicate the support of Multi-homed IPv6 PDU session and the UE has not previously successfully performed the UE-requested PDU session modification to provide this indication, 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 and the UE has not previously successfully performed the UE-requested PDU session modification to provide this indication, 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 an 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, the PDU session is not associated with the control plane only indication, the UE supports more than 16 packet filters for this PDU session, and the UE has not previously successfully performed the UE-requested PDU session modification to provide this indication, 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 an 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 not associated with the control plane only indication, and the UE has not previously successfully performed the UE-requested PDU session modification to include the Integrity protection maximum data rate IE in the PDU SESSION MODIFICATION REQUEST message, 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 an 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 not associated with the control plane only indication, the UE requests the PDU session to be an always-on PDU session in the 5GS and the UE has not previously successfully performed the UE-requested PDU session modification to request this, 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 the UE supports transfer of port management information containers, the UE shall set the TPMIC bit to "Transfer of port management information containers supported" in the 5GSM capability IE of 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 IP header compression configuration, the UE shall include the IP header compression configuration IE in the PDU SESSION MODIFICATION REQUEST message if the network indicated "Control plane CIoT 5GS optimization supported" and "IP header compression for control plane CIoT 5GS optimization supported" in the 5GS network support feature support IE.

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

After an inter-system change from S1 mode to N1 mode, if:

a) the UE is operating in single-registration mode in the network supporting N26 interface;

b) the PDU session type value of the PDU session type IE is set to "IPv4", "IPv6" or "IPv4v6";

c) the UE indicates "Control plane CIoT 5GS optimization supported" and "IP header compression for control plane CIoT 5GS optimization supported" in the 5GMM capability IE of the REGISTRATION REQUEST message; and

d) the network indicates "Control plane CIoT 5GS optimization supported" and "IP header compression for control plane CIoT 5GS optimization supported" in the 5GS network support feature IE of the REGISTRATION ACCEPT message;

the UE shall initiate the PDU session modification procedure to negotiate the IP header compression configuration and include the IP header compression configuration IE in the PDU SESSION MODIFICATION REQUEST message.

The UE shall include the Service-level-AA container IE in the PDU SESSION MODIFICATION REQUEST message, when requesting to modify an established PDU session for C2 communication. In the Service-level-AA container IE, the UE shall include:

a) the service-level device ID with the value set to the CAA-level UAV ID of the UE; and

b) if available, the service-level-AA payload with the value set to the C2 authorization payload and the service-level-AA payload type with the value set to "C2 authorization payload".

NOTE 3: The C2 authorization payload in the service-level-AA payload can include one, some or all of the pairing information for C2 communication, an indication of the request for direct C2 communication, pairing information for direct C2 communication, and the UAV flight authorization information.

The UE may include the Non-3GPP delay budget IE in the PDU SESSION MODIFICATION REQUEST message, when requesting to modify an established PDU session for PIN-DN communication or PIN indirect commmunication.

NOTE 3A: The Non-3GPP delay budget IE can assist the network in providing specific QoS handling for a set of packet filter(s) for the PDU session as specified in subclause 5.44.3.4 of 3GPP TS 23.501 [8].

After an inter-system change from S1 mode to N1 mode, if:

a) the UE is operating in single-registration mode in a network that supports N26 interface;

b) the PDU session type value of the PDU session type IE is set to "Ethernet";

c) the UE indicates "Control plane CIoT 5GS optimization supported" and "Ethernet header compression for control plane CIoT 5GS optimization supported" in the 5GMM capability IE of the REGISTRATION REQUEST message; and

d) the network indicates "Control plane CIoT 5GS optimization supported" and "Ethernet header compression for control plane CIoT 5GS optimization supported" in the 5GS network support feature IE of the REGISTRATION ACCEPT message;

the UE shall initiate the PDU session modification procedure to negotiate the Ethernet header compression configuration and include the Ethernet header compression configuration IE in the PDU SESSION MODIFICATION REQUEST message.

For a PDN connection established when in S1 mode, after an inter-system change from S1 mode to N1 mode, and if the UE is a UE operating in single-registration mode in a network supporting N26 interface, and the UE supports receiving DNS server addresses in protocol configuration options and the UE has not previously successfully performed the UE-requested PDU session modification to indicate this support, the UE shall include the Extended protocol configuration options IE in the PDU SESSION MODIFICATION REQUEST message and:

a) if the PDU session is of "IPv4" or "IPv4v6" PDU session type, the UE shall include the DNS server IPv4 address request; and

b) if the PDU session is of "IPv6" or "IPv4v6" PDU session type, the UE shall include the DNS server IPv6 address request.

For a PDN connection established when in S1 mode, after an inter-system change from S1 mode to N1 mode, and if the UE is a UE operating in single-registration mode in a network supporting N26 interface, and the UE supports the EAS rediscovery and the UE has not previously successfully performed the UE-requested PDU session modification to indicate this support, the UE shall include the Extended protocol configuration options IE in the PDU SESSION MODIFICATION REQUEST message and shall include the EAS rediscovery support indication in the Extended protocol configuration options IE.

For a PDN connection established when in S1 mode, after an inter-system change from S1 mode to N1 mode, and if the UE is a UE operating in single-registration mode in a network supporting N26 interface, and the UE supports the EDC and the UE has not previously successfully performed the UE-requested PDU session modification to indicate this support, then the UE shall include the Extended protocol configuration options IE in the PDU SESSION MODIFICATION REQUEST message and shall include the EDC support indicator in the Extended protocol configuration options IE.

If the UE supports reporting of URSP rule enforcement and is indicated to send URSP rule enforcement report to network based on the matching URSP rule which contains the URSP rule enforcement report indication set to "URSP rule enforcement report is required", the URSP rule enforcement report is associated to:

a) an established PDU session; or

b) a PDN connection, after an inter-system change from S1 mode to N1 mode, and if the UE is a UE operating in single-registration mode in a network supporting N26 interface, the matching URSP rule is newly enforced while the UE was in S1 mode,

then the UE shall include the URSP rule enforcement reports IE in the PDU SESSION MODIFICATION REQUEST message.

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 and not associated with the control plane only indication, after 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 UE may 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 is allowed" in the MA PDU session information IE and set the request type to "modification request" in the UL NAS TRANSPORT message.

NOTE 4: If the DNN corresponds to an LADN DNN, the AMF does not forward the MA PDU session information IE to the SMF but sends the message back to the UE to inform of the unhandled request (see subclause 5.4.5.2.5).

In case the UE executes case a) or b), the UE shall:

1) set the ATSSS-ST bits in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message to indicate the ATSSS-LL and MPTCP functionalities, respectively, which the UE supports (see table 9.11.4.1.1) according to what is specified in subclause 5.32.6.1 of 3GPP TS 23.501 [8]; and

2) set the ATSSS-LL, MPTCP and MPQUIC-UDP bits in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message to indicate the ATSSS-LL, MPTCP and MPQUIC functionalities, respectively, which the UE supports (see table 9.11.4.1.1) according to what is specified in subclause 5.32.6.1 of 3GPP TS 23.501 [8].

NOTE 4A: Usage of the ATSSS-ST bits to indicate support for ATSSS functionality was deprecated in Rel-18 in favor of the ATSSS-LL, MPTCP and MPQUIC-UDP bits. The setting of the ATSSS-ST field in the 5GSM capability IE bits is necessary for backward compatibility with the earlier releases. The UE sets the ATSSS-ST field in the same way as a UE from previous releases.

NOTE 5: The ATSSS Low-Layer functionality cannot be used together with the redundant steering mode. When the UE indicates that it is capable of supporting the ATSSS Low-Layer functionality with any steering mode, it implies that the UE supports the ATSSS Low-Layer functionality with any steering mode except the redundant steering mode.

3) void;

4) void;

5) void;

6) void;

7) void;

8) void.

If a performance measurement function in the UE can perform access performance measurements using the QoS flow of the non-default QoS rule as specified in subclause 5.32.5 of 3GPP TS 23.501 [8], the UE shall set the APMQF bit to "Access performance measurements per QoS flow supported" in the 5GSM capability IE of the PDU SESSION MODIFICATION REQUEST message.

Upon receipt of a PDU SESSION MODIFICATION REQUEST message for MA PDU session modification, the SMF shall check if the ATSSS-LL, MPTCP and MPQUIC-UDP bits (if set) or the ATSSS-ST field in the 5GSM capability IE (if none of the ATSSS-LL, MPTCP and MPQUIC-UDP bits is set) in the PDU SESSION MODIFICATION REQUEST message, indicates:

NOTE 5A: If any of the ATSSS-LL, MPTCP and MPQUIC-UDP bits, respectively, is set, then the SMF ignores the ATSSS-ST bits of the 5GSM capability IE.

a) support for any of the possible steering functionalities in addition to the ATSSS-LL functionality with only active-standby steering mode and:

   i) if the DNN configuration allows for the indicated steering functionality(ies) and the ATSSS-LL functionality with any steering mode (i.e., any steering mode allowed for ATSSS-LL functionality) but does not allow RTT measurement without using PMF protocol, the SMF shall ensure that the modified PDU session has the capability of the indicated steering functionality(ies) and the ATSSS-LL with only active-standby steering mode, load balancing steering mode or priority based steering mode in the downlink andthe indicated steering functionality(ies) and the ATSSS-LL with only active-standby steering mode in the uplink;

   ii) if the DNN configuration allows for the the indicated steering functionality(ies) and the ATSSS-LL functionality with any steering mode (i.e., any steering mode allowed for ATSSS-LL functionality) and allows RTT measurement without using PMF protocol, the SMF shall ensure that the modified PDU session has the capability ofthe indicated steering functionality(ies) and the ATSSS-LL with any steering mode (i.e., any steering mode allowed for ATSSS-LL functionality) in the downlink and the indicated steering functionality(ies) and the ATSSS-LL with only active-standby steering mode in the uplink; or

   iii) if the DNN configuration allows for the indicated steering functionality(ies) and the ATSSS-LL functionality with only active-standby steering mode, the SMF shall ensure that the modified PDU session has the capability of the indicated steering functionality(ies) and the ATSSS-LL with only active-standby steering mode in the downlink and the uplink;

b) support for ATSSS Low-Layer functionality with any steering mode allowed for ATSSS-LL and if the DNN configuration allows for the ATSSS-LL functionality with any steering mode (i.e., any steering mode allowed for ATSSS-LL functionality), the SMF shall ensure that the modified PDU session has the capability of ATSSS-LL with any steering mode (i.e., any steering mode allowed for ATSSS-LL functionality) in the downlink and the uplink;

c) void;

d) void

e) void;

f) void;

g) void;

h) support for any of the possible steering functionalities in addition to the ATSSS-LL functionality with any steering mode (i.e., any steering mode allowed for ATSSS-LL functionality) and if the DNN configuration does not allow for the indicated steering functionality and allows for the ATSSS-LL functionality with any steering mode (i.e., any steering mode allowed for ATSSS-LL functionality), the SMF shall ensure that the established PDU session has the capability of ATSSS-LL with any steering mode (i.e., any steering mode allowed for ATSSS-LL functionality) in the downlink and the uplink; or

i) support for any of the possible steering functionalities in addition to at least ATSSS-LL functionality with only active-standby steering mode and if the DNN configuration does not allow for the indicated steering functionality and allows at least for the ATSSS-LL functionality with only active-standby steering mode, the SMF shall ensure that the established PDU session has the capability of ATSSS-LL with only active-standby steering mode in the downlink and the uplink.

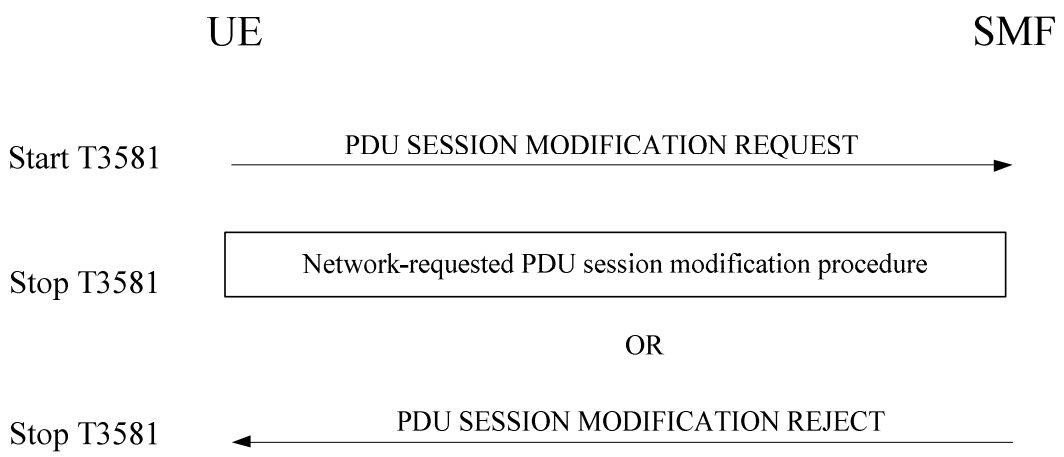


Figure 6.4.2.2.1: UE-requested PDU session modification procedure

6.4.2.3 UE-requested PDU session modification procedure accepted by the network

Upon receipt of a PDU SESSION MODIFICATION REQUEST message, if the SMF accepts the request to modify the PDU session, the SMF shall perform the network-requested PDU session modification procedure as specified in subclause 6.3.2.

If the PDU SESSION MODIFICATION REQUEST message contains a Port management information container IE, the SMF shall handle the contents of the Port management information container IE as specified in 3GPP TS 23.501 [8] and 3GPP TS 23.502 [9].

6.4.2.4 UE-requested PDU session modification procedure not accepted by the network

6.4.2.4.1 General

Upon receipt of a PDU SESSION MODIFICATION REQUEST message, if the SMF does not accepts the request to modify the PDU session, the SMF shall create a PDU SESSION MODIFICATION REJECT message.

The SMF shall set the 5GSM cause IE of the PDU SESSION MODIFICATION REJECT message to indicate the reason for rejecting the PDU session modification.

The 5GSM cause IE typically indicates one of the following SM cause values:

#26 insufficient resources;

#29 user authentication or authorization failed;

#31 request rejected, unspecified;

#32 service option not supported;

#33 requested service option not subscribed;

#35 PTI already in use;

#37 5GS QoS not accepted;

#43 Invalid PDU session identity;

#44 Semantic errors in packet filter(s);

#45 Syntactical error in packet filter(s);

#46 out of LADN service area;

#59 unsupported 5QI value;

#67 insufficient resources for specific slice and DNN;

#69 insufficient resources for specific slice;

#83 Semantic error in the QoS operation;

#84 Syntactical error in the QoS operation; or

#95 – 111 protocol errors.

If the UE requests a PDU session modification for an LADN when the UE is located outside of the LADN service area, the SMF shall include the 5GSM cause value #46 "out of LADN service area" in the 5GSM cause IE of the PDU SESSION MODIFICATION REJECT message.

If the Extended protocol configuration options IE of the PDU SESSION MODIFICATION REQUEST message indicates 3GPP PS data off UE status and the SMF detects the change of the 3GPP PS data off UE status, the SMF shall not include the 5GSM cause value #26 "insufficient resources", the 5GSM cause value #67 "insufficient resources for specific slice and DNN", the 5GSM cause value #69 "insufficient resources for specific slice" and the 5GSM cause value #46 "out of LADN service area" in the 5GSM cause IE of the PDU SESSION MODIFICATION REJECT message.

If the UE initiates UE-requested PDU session modification procedure to modify the PDU session transferred from EPS to an MA PDU session with the Request type IE set to "MA PDU request" in the UL NAS TRANSPORT message as specified in 3GPP TS 24.193 [13B] and the SMF determines, based on operator policy and subscription information, that the PDU SESSION MODIFICATION REQUEST message is to be rejected, the SMF shall include the 5GSM cause value #33 "requested service option not subscribed" in the 5GSM cause IE of the PDU SESSION MODIFICATION REJECT message.

NOTE: If the SMF determines, based on operator policy and subscription information, that the PDU SESSION MODIFICATION REQUEST message is to be accepted as single access PDU session, the ATSSS container IE cannot be included in the PDU SESSION MODIFICATION COMMAND message.

The network may include a Back-off timer value IE in the PDU SESSION MODIFICATION REJECT message.

If the 5GSM cause value is #26"insufficient resources", #67 "insufficient resources for specific slice and DNN", or #69 "insufficient resources for specific slice" and the PDU SESSION MODIFICATION REQUEST message was received from a UE configured for high priority access in selected PLMN or SNPN or the request type provided during the PDU session establishment is set to "initial emergency request" or "existing emergency PDU session", the network shall not include a Back-off timer value IE.

The SMF shall send the PDU SESSION MODIFICATION REJECT message.

Upon receipt of a PDU SESSION MODIFICATION REJECT message and a PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5, the UE shall stop timer T3581, release the allocated PTI value, and enter the state PROCEDURE TRANSACTION INACTIVE.

If the PDU SESSION MODIFICATION REQUEST message was sent with the Requested MBS container IE included and the MBS operation set to "Join MBS session", and the UE receives a PDU SESSION MODIFICATION REJECT message, then the UE shall consider the requested MBS join as rejected.

If the PDU SESSION MODIFICATION REQUEST message was sent with the Requested MBS container IE included and the MBS operation set to "Leave MBS session", and the UE receives a PDU SESSION MODIFICATION REJECT message, then the UE shall locally leave the multicast MBS session(s) corresponding to the TMGI(s) in the Requested MBS container IE of the PDU SESSION MODIFICATION REQUEST message.

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 or SNPN, 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. In an SNPN, the timer T3396 to be stopped includes:

   1) the timer T3396 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

   2) the timer T3396 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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, SNPN 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. In an SNPN, the timer T3396 to be stopped includes:

   1) the timer T3396 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

   2) the timer T3396 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated, or the UE receives a PDU SESSION MODIFICATION COMMAND message for the same DNN from the network, or a PDU SESSION AUTHENTICATION 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, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated, or the UE receives a PDU SESSION MODIFICATION COMMAND message for a non-emergency PDU session established without a DNN provided by the UE, a PDU SESSION AUTHENTICATION 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, SNPN 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. In an SNPN, the timer T3396 to be stopped includes:

i) the timer T3396 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

ii) the timer T3396 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE 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. In an SNPN, the timer T3396 to be stopped includes:

i) the timer T3396 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

ii) the timer T3396 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE 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.

In an SNPN, if the UE supports equivalent SNPNs then the UE shall apply the timer T3396 for all the equivalent SNPNs. Otherwise, the UE shall apply the timer T3396 for the registered SNPN.

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 as specified in subclause 6.2.7.

If the timer T3396 is running when the UE enters state 5GMM-DEREGISTERED, the UE remains switched on, and the USIM in the UE (if any) remains the same and the entry in the "list of subscriber data" for the SNPN to which timer T3396 is associated (if any) is not updated, 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 (if any) remains the same and the entry in the "list of subscriber data" for the SNPN to which timer T3396 is associated (if any) is not updated 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 an 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 or SNPN, exceptions are specified in subclause 6.2.8):

a) If the timer value indicates neither zero nor deactivated, and both an S-NSSAI and a DNN were provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [S-NSSAI of the PDU session, DNN] combination, if it is running. If the timer value indicates neither zero nor deactivated, an S-NSSAI 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 of the PDU session, no DNN] combination, if it is running. If the timer value indicates neither zero nor deactivated, no S-NSSAI and a DNN was provided during the PDU session establishment, the UE shall stop timer T3584 associated with the [no S-NSSAI, DNN] combination, 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 the [no S-NSSAI, no DNN] combination, if it is running. The timer T3584 to be stopped includes:

   1) in a PLMN:

      i) the timer T3584 applied for all the PLMNs, if running; and

      ii) the timer T3584 applied for the registered PLMN, if running; or

   2) in an SNPN:

      i) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

      ii) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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 the exception of those identified in subclause 6.4.2.1, for the [S-NSSAI, DNN] combination, 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 the exception of those identified in subclause 6.4.2.1, for the [S-NSSAI of the PDU session, no DNN] combination, 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 the exception of those identified in subclause 6.4.2.1, for the [no S-NSSAI, DNN] combination, 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 the exception of those identified in subclause 6.4.2.1, for the [no S-NSSAI, no DNN] combination, 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, SNPN change, or inter-system change;

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

1) if both S-NSSAI and DNN were provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [S-NSSAI of the PDU session, DNN] combination, if running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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 [S-NSSAI of the PDU session, DNN] combination that was sent by the UE, until the UE is switched off, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated, or the UE receives a PDU SESSION MODIFICATION COMMAND message for the [S-NSSAI of the PDU session, DNN] combination from the network, or a PDU SESSION AUTHENTICATION COMMAND message for the [S-NSSAI of the PDU session, DNN] combination from the network, or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE for the [S-NSSAI of the PDU session, DNN] combination from the network;

2) if an S-NSSAI was provided but a DNN was not provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [S-NSSAI of the PDU session, no DNN] combination, if running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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 [S-NSSAI of the PDU session, no DNN] combination, if no DNN was provided during the PDU session establishment, until the UE is switched off, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated, or the UE receives a PDU SESSION MODIFICATION COMMAND message for a non-emergency PDU session established for the [S-NSSAI of the PDU session, no DNN] combination from the network, or a PDU SESSION AUTHENTICATION COMMAND message for a non-emergency PDU session established for the [S-NSSAI of the PDU session, 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 [S-NSSAI of the PDU session, no DNN] combination from the network;

3) if an S-NSSAI was not provided but a DNN was provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [no S-NSSAI, DNN] combination, if running. The timer T3584 to be stopped includes:

   i) in a PLMN:

      A) the timer T3584 applied for all the PLMNs, if running; and

      B) the timer T3584 applied for the registered PLMN, if running; or

   ii) in an SNPN:

      A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

      B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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 [no S-NSSAI, DNN] combination, if no S-NSSAI was provided during the PDU session establishment, until the UE is switched off, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated, or the UE receives a PDU SESSION MODIFICATION COMMAND message for the [no S-NSSAI, DNN] combination from the network, or a PDU SESSION AUTHENTICATION COMMAND message for the [no S-NSSAI, DNN] combination from the network, or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE for the [no S-NSSAI, DNN] combination from the network; and

4) if neither S-NSSAI nor DNN were provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [no S-NSSAI, no DNN] combination, if running. The timer T3584 to be stopped includes:

   i) in a PLMN:

      A) the timer T3584 applied for all the PLMNs, if running; and

      B) the timer T3584 applied for the registered PLMN, if running; or

   ii) in an SNPN:

      A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

      B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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 [no S-NSSAI, no DNN] combination, if neither S-NSSAI nor DNN was provided during the PDU session establishment, until the UE is switched off, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated, or the UE receives a PDU SESSION MODIFICATION COMMAND message for a non-emergency PDU session established for the [no S-NSSAI, no DNN] combination from the network, or a PDU SESSION AUTHENTICATION COMMAND message for a non-emergency PDU session established for the [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 [no S-NSSAI, no DNN] combination from the network.

The timer T3584 remains deactivated upon a PLMN change, SNPN change, or inter-system change; and

c) if the timer value indicates zero:

1) if both S-NSSAI and DNN were provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [S-NSSAI of the PDU session, DNN] combination, if running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE may send another PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST message for the [S-NSSAI of the PDU session, DNN] combination;

2) if an S-NSSAI was provided but a DNN was not provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [S-NSSAI of the PDU session, no DNN] combination, if running. The timer T3584 to be stopped includes:

i) in a PLMN:

A) the timer T3584 applied for all the PLMNs, if running; and

B) the timer T3584 applied for the registered PLMN, if running; or

ii) in an SNPN:

A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE may send another PDU SESSION ESTABLISHMENT REQUEST message, or PDU SESSION MODIFICATION REQUEST message for the [S-NSSAI of the PDU session, no DNN] combination if the request type was different from "initial emergency request" and different from "existing emergency PDU session";

3) if an S-NSSAI was not provided but a DNN was provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [no S-NSSAI, DNN] combination, if running. The timer T3584 to be stopped includes:

   i) in a PLMN:

      A) the timer T3584 applied for all the PLMNs, if running; and

      B) the timer T3584 applied for the registered PLMN, if running; or

   ii) in an SNPN:

      A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

      B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

   The UE may send another PDU SESSION ESTABLISHMENT REQUEST message, or PDU SESSION MODIFICATION REQUEST message for the [no S-NSSAI, DNN] combination; and

4) if neither S-NSSAI nor DNN were provided by the UE during the PDU session establishment, the UE shall stop timer T3584 associated with the [no S-NSSAI, no DNN] combination, if running. The timer T3584 to be stopped includes:

   i) in a PLMN:

      A) the timer T3584 applied for all the PLMNs, if running; and

      B) the timer T3584 applied for the registered PLMN, if running; or

   ii) in an SNPN:

      A) the timer T3584 applied for all the equivalent SNPNs, and associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

      B) the timer T3584 applied for the registered SNPN, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

   The UE may send another PDU SESSION ESTABLISHMENT REQUEST message, or PDU SESSION MODIFICATION REQUEST message for the [no S-NSSAI, no DNN] combination 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 with the ABO bit set to "The back-off timer is applied in all PLMNs or all equivalent SNPNs" 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 or all the equivalent SNPNs. Otherwise, the UE shall apply the timer T3584 for the registered PLMN or the registered SNPN.

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 as specified in subclause 6.2.8.

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 (if any) remains the same and the entry in the "list of subscriber data" for the SNPN to which timer T3584 is associated (if any) is not updated, 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 (if any) remains the same and the entry in the "list of subscriber data" for the SNPN to which timer T3584 is associated (if any) is not updated 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 an 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 or SNPN, 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 S-NSSAI of the PDU session, 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 timer T3585 to be stopped includes:

   1) in a PLMN:

      i) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION MODIFICATION REJECT is received, if running;

      ii) the timer T3585 applied for all the PLMNs and for both 3GPP access type and non-3GPP access type, if running;

      iii) the timer T3585 applied for the registered PLMN and for the access over which the PDU SESSION MODIFICATION REJECT is received, if running; and

      iv)- the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, if running; or

   2) in an SNPN:

      i) the timer T3585 applied for all the equivalent SNPNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

      ii) the timer T3585 applied for all the equivalent SNPNs and for both 3GPP access type and non-3GPP access type, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

      iii) the timer T3585 applied for the registered SNPN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both,

associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

iv) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if 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) if an S-NSSAI was provided by the UE during the PDU session establishment, the UE 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 S-NSSAI of the PDU session, until timer T3585 expires or timer T3585 is stopped; and

2) if the request type was different from "initial emergency request" and from "existing emergency PDU session", and an S-NSSAI was not provided by the UE during the PDU session establishment, the UE 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, until timer T3585 expires or timer T3585 is stopped.

The UE shall not stop timer T3585 upon a PLMN change, SNPN 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 S-NSSAI of the PDU session, 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 timer T3585 to be stopped includes:

1) in a PLMN:

i) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION MODIFICATION REJECT is received, if running;

ii) the timer T3585 applied for all the PLMNs and for both 3GPP access type and non-3GPP access type, if running;

iii) the timer T3585 applied for the registered PLMN and for the access over which the PDU SESSION MODIFICATION REJECT is received, if running; and

iv) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, if running; or

2) in an SNPN:

i) the timer T3585 applied for all the equivalent SNPNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

ii) the timer T3585 applied for all the equivalent SNPNs and for both 3GPP access type and non-3GPP access type, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

iii) the timer T3585 applied for the registered SNPN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

iv) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

In addition:

1) if an S-NSSAI was provided by the UE during the PDU session establishment, the UE 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 S-NSSAI of the PDU session until the UE is switched off, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated, or the UE receives a PDU SESSION MODIFICATION COMMAND message for a non-emergency PDU session for the S-NSSAI of the PDU session from the network, or a PDU SESSION AUTHENTICATION COMMAND message for a non-emergency PDU session for the S-NSSAI of the PDU session from the network, or a PDU SESSION RELEASE COMMAND message without the Back-off timer value IE for the S-NSSAI of the PDU session from the network; and

2) if the request type was different from "initial emergency request" and from "existing emergency PDU session", and an S-NSSAI was not provided by the UE during the PDU session establishment, the UE 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, until the UE is switched off, the USIM is removed, the entry in the "list of subscriber data" for the current SNPN is updated, 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 AUTHENTICATION 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, SNPN change, or inter-system change; and

c) if the timer value indicates zero:

1) if an S-NSSAI was provided by the UE during the PDU session establishment, the UE shall stop timer T3585 associated with the S-NSSAI of the PDU session, if running. The timer T3585 to be stopped includes:

i) in a PLMN:

A) including the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION RELEASE COMMAND is received, if running;

B) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION RELEASE COMMAND is received, if running;

C) the timer T3585 applied for the registered PLMN and for current access type or both 3GPP access type and non-3GPP access type, if running; and

D) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, if running; or

ii) in an SNPN:

A) the timer T3585 applied for all the equivalent SNPNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

B) the timer T3585 applied for all the equivalent SNPNs and for both 3GPP access type and non-3GPP access type, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

C) the timer T3585 applied for the registered SNPN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN and, if the UE

supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

D) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE may send another PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST message for the S-NSSAI of the PDU session; 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 The timer T3585 to be stopped includes:

i) in a PLMN:

A) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION RELEASE COMMAND is received, if running;

B) the timer T3585 applied for all the PLMNs and for the access over which the PDU SESSION RELEASE COMMAND is received, if running;

C) the timer T3585 applied for the registered PLMN and for current access type or both 3GPP access type and non-3GPP access type, if running; and

D) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, if running; or

ii) in an SNPN:

A) the timer T3585 applied for all the equivalent SNPNs and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

B) the timer T3585 applied for all the equivalent SNPNs and for both 3GPP access type and non-3GPP access type, associated with the RSNPN or an equivalent SNPN and with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running;

C) the timer T3585 applied for the registered SNPN and for the access over which the PDU SESSION AUTHENTICATION COMMAND message is received, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running; and

D) the timer T3585 applied for the registered PLMN and for both 3GPP access type and non-3GPP access type, associated with the RSNPN and, if the UE supports access to an SNPN using credentials from a credentials holder, equivalent SNPNs or both, associated with the selected entry of the "list of subscriber data" or the selected PLMN subscription, if running.

The UE 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 with the ABO bit set to "The back-off timer is applied in all PLMNs or all SNPNs " 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 or all the equivalent SNPNs. Otherwise, the UE shall apply the timer T3585 for the registered PLMN or the registered SNPN.

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 as specified in subclause 6.2.8.

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 (if any) remains the same and the entry in the "list of subscriber data" for the SNPN to which timer T3585 is associated (if any) is not updated, 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 (if any) remains the same and the entry in the "list of subscriber data" for the SNPN to which timer T3585 is associated (if any) is not updated 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 an 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 3: As described in this subclause, upon PLMN change, SNPN 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 or SNPN change, if T3584 applied for the registered PLMN or the registered SNPN is running or is deactivated for an S-NSSAI, a DNN, and old PLMN or old SNPN, but T3584 is not running and is not deactivated for the S-NSSAI, the DNN, and new PLMN or new SNPN, 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 or new SNPN.

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

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

6.4.2.4.3 Handling of network rejection not due to congestion control

If the 5GSM cause value is different from #26 "insufficient resources", #37 "5GS QoS not accepted", #44 "Semantic errors in packet filter(s)", #45 "Syntactical error in packet filter(s)", #46 "out of LADN service area", #59 "unsupported 5QI value", #67 "insufficient resources for specific slice and DNN", #69 "insufficient resources for specific slice", #83 "Semantic error in the QoS operation", and #84 "Syntactical error in the QoS operation", and the Back-off timer value IE is included, the UE shall behave as follows: (if the UE is a UE configured for high priority access in selected PLMN or SNPN, exceptions are specified in subclause 6.2.12):

a) if the timer value indicates neither zero nor deactivated and:

   1) if the UE provided DNN and S-NSSAI to the network during the PDU session establishment, the UE shall start the back-off timer with the value provided in the Back-off timer value IE for the PDU session modification procedure and:

      i) in a PLMN, [PLMN, DNN, (mapped) HPLMN S-NSSAI of the PDU session] combination. The UE shall not send another PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for the same DNN and the (mapped) HPLMN S-NSSAI of the PDU session in the current PLMN, until the back-off timer expires, the UE is switched off, or the USIM is removed; or

ii) in an SNPN, [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, (mapped) subscribed SNPN S-NSSAI] combination. The UE shall not send another PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for the same DNN and (mapped) subscribed SNPN S-NSSAI of the PDU session in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the back-off timer expires, the UE is switched off, the USIM is removed, or the selected entry of the "list of subscriber data" is updated;

2) if the UE did not provide a DNN or S-NSSAI or any of the two parameters to the network during the PDU session establishment, it shall start the back-off timer accordingly for the PDU session modification procedure and:

i) in a PLMN, [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, (mapped) HPLMN S-NSSAI of the PDU session] or [PLMN, no DNN, no S-NSSAI] combination. Dependent on the combination, the UE shall not send another PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for the same [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, (mapped) HPLMN S-NSSAI of the PDU session] or [PLMN, no DNN, no S-NSSAI] combination in the current PLMN, until the back-off timer expires, the UE is switched off, or the USIM is removed; or

ii) in an SNPN, [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI of the PDU session] or [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] combination. Dependent on the combination, the UE shall not send another PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for the same [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI of the PDU session] or [SNPN, selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] combination in the current SNPN, until the back-off timer expires, the UE is switched off, the USIM is removed, or the selected entry in the "list of subscriber data" is updated;

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

1) if the UE provided DNN and S-NSSAI to the network during the PDU session establishment, the UE shall not send another PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for:

i) in a PLMN, the same DNN and the (mapped) HPLMN S-NSSAI of the PDU session in the current PLMN, until the UE is switched off, or the USIM is removed; or

ii) in an SNPN, the same DNN and the (mapped) subscribed SNPN S-NSSAI of the PDU session in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the UE is switched off, or the USIM is removed, or the selected entry in the "list of subscriber data";

2) if the UE did not provide a DNN or S-NSSAI or any of the two parameters to the network during the PDU session establishment, the UE shall not send another PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, for:

i) in a PLMN; the same [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, (mapped) HPLMN S-NSSAI of the PDU session] or [PLMN, no DNN, no S-NSSAI] combination in the current PLMN, until the UE is switched off, or the USIM is removed; or

ii) in an SNPN, the same [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI of the PDU session] or [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] combination in the current SNPN using the selected entry of the "list of subscriber data" or selected PLMN subscription, until the UE is switched off, the USIM is removed, or the selected entry in the "list of subscriber data" is updated; and

c) if the timer value indicates zero, the UE may send another PDU SESSION MODIFICATION REQUEST message for:

1) in a PLMN, the same combination of [PLMN, DNN, (mapped) HPLMN S-NSSAI of the PDU session], [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, (mapped) HPLMN S-NSSAI of the PDU session], or [PLMN, no DNN, no S-NSSAI] in the current PLMN; or

2) in an SNPN, the same combination of [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, (mapped) subscribed SNPN S-NSSAI of the PDU session], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI of the PDU session], or [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] in the current SNPN.

If the Back-off timer value IE is not included, then the UE shall ignore the Re-attempt indicator IE provided by the network in the PDU SESSION MODIFICATION REJECT message, if any.

a) Additionally, if the 5GSM cause value is #32 "service option not supported", or #33 "requested service option not subscribed", then:

1) the UE not operating in SNPN access operation mode shall proceed as follows:

i) if the UE is registered in the HPLMN or in a PLMN that is within the EHPLMN list, the UE shall behave as described above in the present subclause using the configured SM Retry Timer value as specified in 3GPP TS 24.368 [17] or in USIM file NAS_{CONFIG} as specified in 3GPP TS 31.102 [22], if available, as back-off timer value; and

NOTE 1: The way to choose one of the configured SM Retry Timer values for back-off timer value is up to UE implementation if the UE is configured with:
- an SM Retry Timer value in the ME as specified in 3GPP TS 24.368 [17]; and
- an SM Retry Timer value in USIM file NAS_{CONFIG} as specified in 3GPP TS 31.102 [22].

ii) otherwise, if the UE is not registered in its HPLMN or in a PLMN that is within the EHPLMN list, or if the SM Retry Timer value is not configured, the UE shall behave as described above in the present subclause, using the default value of 12 minutes for the back-off timer; or

2) the UE operating in SNPN access operation mode shall proceed as follows:

i) if:

A) the SM Retry Timer value for the current SNPN as specified in 3GPP TS 24.368 [17] is available; or

B) the SM Retry Timer value in USIM file NAS_{CONFIG} as specified in 3GPP TS 31.102 [22] is available and the UE used the USIM for registration to the current SNPN;

then the UE shall behave as described above in the present subclause using the configured SM Retry Timer value as back-off timer value; or

NOTE 2: The way to choose one of the configured SM Retry Timer values for back-off timer value is up to UE implementation if both conditions in bullets A) and B) above are satisfied.

ii) otherwise, the UE shall behave as described above in the present subclause, using the default value of 12 minutes for the back-off timer.

b) For 5GSM cause values different from #32 "service option not supported", or #33 "requested service option not subscribed", the UE behaviour regarding the start of a back-off timer is specified in subclause 6.2.12.

The UE shall not stop any back-off timer:

a) upon a PLMN or SNPN change;

b) upon an inter-system change; or

c) upon registration over another access type.

If the network indicates that a back-off timer for the PDU session modification procedure is deactivated, then it remains deactivated:

a) upon a PLMN or SNPN change;

b) upon an inter-system change; or

c) upon registration over another access type.

NOTE 3: This means the back-off timer can still be running or be deactivated for the given 5GSM procedure when the UE returns to the PLMN or SNPN 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 MODIFICATION REQUEST message for the combination of [PLMN, DNN, (mapped) HPLMN S-NSSAI of the PDU session], [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, (mapped) HPLMN S-NSSAI of the PDU session], or [PLMN, no DNN, no S-NSSAI] in the PLMN, or for the combination of [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, (mapped) subscribed S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed S-NSSAI], or [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] in the SNPN.

If the back-off timer is started upon receipt of a PDU SESSION MODIFICATION REJECT (i.e. the timer value was provided by the network, a configured value is available or the default value is used as explained above) or the back-off timer is deactivated, the UE behaves as follows:

a) after a PLMN or SNPN change the UE may send a PDU SESSION MODIFICATION REQUEST message for:

1) in a PLMN, the combination of [new PLMN, DNN, (mapped) HPLMN S-NSSAI of the PDU session], [new PLMN, DNN, no S-NSSAI], [new PLMN, no DNN, (mapped) HPLMN S-NSSAI of the PDU session], or [new PLMN, no DNN, no S-NSSAI] in the new PLMN, if the back-off timer is not running and is not deactivated for the PDU session modification procedure and the combination of [new PLMN, DNN, (mapped) HPLMN S-NSSAI of the PDU session], [new PLMN, DNN, no S-NSSAI], [new PLMN, no DNN, (mapped) HPLMN S-NSSAI of the PDU session], or [new PLMN, no DNN, no S-NSSAI]; or

2) in an SNPN, the combination of [new SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, (mapped) subscribed SNPN S-NSSAI of the PDU session], [new SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [new SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI of the PDU session], or [new SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] in the new SNPN, if the back-off timer is not running and is not deactivated for the PDU session modification procedure and the combination of [new SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, (mapped) subscribed SNPN S-NSSAI of the PDU session], [new SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [new SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI of the PDU session], or [new SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI];

Furthermore, as an implementation option, for the 5GSM cause value #32 "service option not supported" or #33 "requested service option not subscribed", if the network does not include a Re-attempt indicator IE, the UE may decide not to automatically send another PDU SESSION MODIFICATION REQUEST message:

1) in a PLMN, the same combination of [PLMN, DNN, (mapped) HPLMN S-NSSAI of the PDU session], [PLMN, DNN, no S-NSSAI], [PLMN, no DNN, (mapped) HPLMN S-NSSAI of the PDU session], or [PLMN, no DNN, no S-NSSAI], if the UE is registered to a new PLMN which is in the list of equivalent PLMNs; or

2) in an SNPN, if the UE supports equivalent SNPNs, the same combination of [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, (mapped) subscribed SNPN S-NSSAI of the PDU session], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI of the PDU session], or [SNPN, the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI], if the UE is registered to a new SNPN which is in the list of equivalent SNPNs.

b) if the network does not include the Re-attempt indicator IE to indicate whether re-attempt in S1 mode is allowed, or the UE ignores the Re-attempt indicator IE, e.g. because the Back-off timer value IE is not included, then:

1) if the UE is registered in its HPLMN or in a PLMN that is within the EHPLMN list and the back-off timer is running for the combination of [PLMN, DNN, (mapped) HPLMN S-NSSAI of the PDU session] or [PLMN DNN, no S-NSSAI], the UE shall apply the configured SM_RetryAtRATChange value as specified in 3GPP TS 24.368 [17] or in USIM file NAS_{CONFIG} as specified in 3GPP TS 31.102 [22], if available, to determine whether the UE may attempt an EPS bearer resource allocation procedure or an EPS bearer resource modification procedure for the same [PLMN, DNN] combination in S1 mode; and

NOTE 4: The way to choose one of the configured SM_RetryAtRATChange values for back-off timer value is up to UE implementation if the UE is configured with:
- an SM_RetryAtRATChange value in ME as specified in 3GPP TS 24.368 [17]; and
- an SM_RetryAtRATChange value in USIM file NAS_{CONFIG} as specified in 3GPP TS 31.102 [22].

2) if the UE is not registered in its HPLMN or in a PLMN that is within the EHPLMN list, or if the NAS configuration MO as specified in 3GPP TS 24.368 [17] is not available and the value for inter-system change is not configured in the USIM file NAS_{CONFIG}, then the UE behaviour regarding an EPS bearer resource allocation procedure or an EPS bearer resource modification procedure for the same [PLMN, DNN] combination in S1 mode is unspecified; and

c) if the network includes the Re-attempt indicator IE indicating that re-attempt in an equivalent PLMN or equivalent SNPN is not allowed, then depending on the timer value received in the Back-off timer value IE, for:

1) in a PLMN, each combination of a PLMN from the equivalent PLMN list and the respective [DNN, (mapped) HPLMN S-NSSAI of the PDU session], [DNN, no S-NSSAI], [no DNN, (mapped) HPLMN S-NSSAI of the PDU session], or [no DNN, no S-NSSAI] combination, the UE shall start a back-off timer for the PDU session modification procedure with the value provided by the network, or deactivate the respective back-off timer as follows:

i) if the Re-attempt indicator IE additionally indicates that re-attempt in S1 mode is allowed, the UE shall start or deactivate the back-off timer for N1 mode only; and

ii) otherwise, the UE shall start or deactivate the back-off timer for S1 and N1 mode

2) in a SNPN, if the UE supports equivalent SNPNs, each combination of a SNPN from the equivalent SNPN list and the respective [the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, (mapped) subscribed SNPN S-NSSAI of the PDU session], [the selected entry of the "list of subscriber data" or selected PLMN subscription, DNN, no S-NSSAI], [the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, (mapped) subscribed SNPN S-NSSAI of the PDU session], or [the selected entry of the "list of subscriber data" or selected PLMN subscription, no DNN, no S-NSSAI] combination, the UE shall start a back-off timer for the PDU session modification procedure with the value provided by the network, or deactivate the respective back-off timer, for N1 mode in an SNPN.

If the back-off timer for a [PLMN, DNN] or [PLMN, no DNN] combination was started or deactivated in S1 mode upon receipt of BEARER RESOURCE ALLOCATION REJECT message or BEARER RESOURCE MODIFICATION REJECT message (see 3GPP TS 24.301 [15]) and the network indicated that re-attempt in N1 mode is allowed, then this back-off timer does not prevent the UE from sending a PDU SESSION MODIFICATION REQUEST message in this PLMN for the same DNN after inter-system change to N1 mode. If the network indicated that re-attempt in N1 mode is not allowed, the UE shall not send any PDU SESSION MODIFICATION REQUEST message with exception of those identified in subclause 6.4.2.1, in this PLMN for the same DNN in combination with any S-NSSAI or without S-NSSAI, after inter-system change to N1 mode until the timer expires, the UE is switched off or the USIM is removed.

NOTE 5: The back-off timer is used to describe a logical model of the required UE behaviour. This model does not imply any specific implementation, e.g. as a timer or timestamp.

NOTE 6: Reference to back-off timer in this section can either refer to use of timer T3396 or to use of a different packet system specific timer within the UE. Whether the UE uses T3396 as a back-off timer or it uses different packet system specific timers as back-off timers is left up to UE implementation.

If the 5GSM cause value is #46 "out of LADN service area", the UE shall ignore the Back-off timer value IE and Re-attempt indicator IE provided by the network, if any. If the UE is not located inside the LADN service area, the UE shall not send another PDU SESSION MODIFICATION REQUEST message except for indicating a change of 3GPP PS data off UE status or another PDU SESSION ESTABLISHMENT REQUEST message for the LADN DNN provided by the UE during the PDU session establishment procedure until the LADN information for the specific LADN DNN or the extended LADN information for the specific LADN DNN and S-NSSAI is updated as described in subclause 5.4.4 and subclause 5.5.1. If the UE is not located inside the LADN service area, the UE shall not indicate the

PDU session(s) for the LADN DNN provided by the UE during the PDU session establishment procedure in the Uplink data status IE included in the SERVICE REQUEST message until the LADN information for the specific LADN DNN or the extended LADN information for the specific LADN DNN and S-NSSAI is provided by network as described in subclause 5.4.4 and subclause 5.5.1.

NOTE 7: Based on UE implementation, the UE locating inside the LADN service area can send another PDU SESSION ESTABLISHMENT REQUEST message or PDU SESSION MODIFICATION REQUEST message for the LADN DNN which was rejected with the 5GSM cause value #46 "out of LADN service area".

NOTE 7A: If the UE does not receive a CONFIGURATION UPDATE COMMAND message with new LADN information within an implementation dependent time, the UE can request this information by initiating a registration procedure for mobility or periodic registration update (see subclause 5.5.1.3.2, item q).

If the 5GSM cause value is #37 "5GS QoS not accepted", #44 "Semantic errors in packet filter(s)", #45 "Syntactical error in packet filter(s)", #59 "unsupported 5QI value", #83 "Semantic error in the QoS operation" or #84 "Syntactical error in the QoS operation", the UE shall ignore the Back-off timer value IE and Re-attempt indicator IE provided by the network, if any. The UE should pass the corresponding error cause to the upper layers.

NOTE 8: How to solve the issues of not accepted 5GS QoS and unsupported 5QI value in the upper layers is UE implementation specific.

6.4.2.5 Abnormal cases in the UE

The following abnormal cases can be identified:

a) Expiry of timer T3581.

The UE shall, on the first expiry of the timer T3581, retransmit the PDU SESSION MODIFICATION REQUEST message and the PDU session information which was transported together with the initial transmission of the PDU SESSION MODIFICATION REQUEST message and shall reset and start timer T3581. This retransmission is repeated four times, i.e. on the fifth expiry of timer T3581, the UE shall abort the procedure and shall release the allocated PTI.

b) Invalid PDU session identity.

Upon receipt of the PDU SESSION MODIFICATION REJECT message including 5GSM cause #43 "invalid PDU session identity", the UE shall perform a local release of the existing PDU session and shall stop the timer T3581.

c) Collision of network-requested PDU session release procedure and UE-requested PDU session modification procedure.

If the UE receives a PDU SESSION RELEASE COMMAND message during the UE-requested PDU session modification procedure, and the PDU session indicated in the PDU SESSION RELEASE COMMAND message is the PDU session that the UE had requested to modify, the UE shall abort the PDU session modification procedure and proceed with the network-requested PDU session release procedure.

d) Handling DL user data packets marked with RQI when UE has already revoked the usage of reflective QoS

If the UE receives a DL user data packet marked with a RQI and the DL user data packet belongs to a PDU session of IPv4, IPv6, IPv4v6 or Ethernet PDU session type for which the UE has already revoked the usage of reflective QoS, then the UE shall ignore the RQI and shall handle the received DL user data packet.

e) Collision of network-requested PDU session modification procedure and UE-requested PDU session modification procedure.

The handling of the same abnormal case as described in subclause 6.3.2.6 applies.

f) Upon receiving an indication that the 5GSM message was not forwarded due to service area restrictions along with a PDU SESSION MODIFICATION REQUEST message with the PDU session ID IE set to the same value as the PDU session ID that was sent by the UE, the UE shall abort the procedure and shall stop the timer T3581.

g) Upon receiving an indication that the 5GSM message was not forwarded due to routing failure along with a PDU SESSION MODIFICATION REQUEST message with the PDU session ID IE set to the same value as the PDU session ID that was sent by the UE, the UE shall stop timer T3581 and shall abort the procedure.

ga) Upon receiving an indication that the 5GSM message was not forwarded because the UE accessing via a satellite NG-RAN cell is informed that the PLMN is not allowed to operate at the present UE location along with a PDU SESSION MODIFICATION REQUEST message with the PDU session ID IE set to the same value as the PDU session ID that was sent by the UE, the UE shall stop timer T3581 and shall abort the procedure.

gb) Upon receiving an indication that the 5GSM message was not forwarded due to unexpected cause along with a PDU SESSION MODIFICATION REQUEST message with the PDU session ID IE set to the same value as the PDU session ID that was sent by the UE, the UE shall stop timer T3581 and shall abort the procedure.

h) Collision of UE-requested PDU session modification procedure and N1 NAS signalling connection release

The UE may immediately retransmit the PDU SESSION MODIFICATION REQUEST message and stop, reset and restart timer T3581, if the following conditions apply:

1) The original UE-requested PDU session modification procedure was initiated over an existing N1 NAS signalling connection; and

2) the previous transmission of the PDU SESSION MODIFICATION REQUEST message was not initiated due to timer T3581 expiry.

i) Rejection of a UE-requested PDU session modification procedure when the UE has initiated the procedure to delete one or more non-default QoS rules for the PDU session:

Upon receipt of a PDU SESSION MODIFICATION REJECT message with 5GSM cause value #31 "request rejected, unspecified", if the UE had initiated deletion of one or more non-default QoS rules for the PDU session, as an implementation option,

1) it may perform a local release of the PDU session and shall stop the timer T3581. In order to synchronize the PDU session context with the AMF, the UE shall perform the registration procedure for mobility and periodic registration update with a REGISTRATION REQUEST message including the PDU session status IE; or

2) it shall stop the timer T3581 and initiate the UE-requested PDU session release procedure.

NOTE: The UE can delay the release of the PDU session until there is no pending data transferred through the other QoS flows of the PDU session.

6.4.2.6 Abnormal cases on the network side

The following abnormal cases can be identified:

a) If the PDU session is an emergency PDU session and the 5GSM cause IE is not included in the PDU SESSION MODIFICATION REQUEST message which is not triggered according to subclause 6.4.2.1, item e), or is set to a 5GSM cause other than the 5GSM causes #41, #42, #44, #45, #83, #84, and #85, the SMF shall reject the PDU SESSION MODIFICATION REQUEST message with 5GSM cause #31 "request rejected, unspecified".

b) PDU session inactive for the received PDU session identity.

If the PDU session ID in the PDU SESSION MODIFICATION REQUEST message belongs to any PDU session in state PDU SESSION INACTIVE in the SMF, the SMF shall set the 5GSM cause IE to #43 "Invalid PDU session identity" in the PDU SESSION MODIFICATION REJECT message.

c) Collision of network-requested PDU session modification procedure and UE-requested PDU session modification procedure.

The handling of the same abnormal case as described in subclause 6.3.2.5 applies.

d) AMF provides a "message was exempted from the DNN based congestion activated in the AMF" but the UE-requested PDU session modification procedure is not exempt from DNN based congestion control.

If the SMF receives an exemptionInd attribute indicating "message was exempted from the DNN based congestion activated in the AMF" as specified in 3GPP TS 29.502 [20A], and the Extended protocol configuration options IE of the PDU SESSION MODIFICATION REQUEST message does not indicate 3GPP PS data off UE status, then the SMF shall set the 5GSM cause #26 "insufficient resources" in the PDU SESSION MODIFICATION REJECT message.

e) AMF provides a "message was exempted from the S-NSSAI and DNN based congestion activated in the AMF" but the UE-requested PDU session modification procedure is not exempt from S-NSSAI only based congestion control.

If the SMF receives an exemptionInd attribute indicating "message was exempted from the S-NSSAI and DNN based congestion activated in the AMF" as specified in 3GPP TS 29.502 [20A], and the Extended protocol configuration options IE of the PDU SESSION MODIFICATION REQUEST message does not indicate 3GPP PS data off UE status, then the SMF shall set the 5GSM cause #67 "insufficient resources for specific slice and DNN" in the PDU SESSION MODIFICATION REJECT message.

f) AMF provides a "message was exempted from the S-NSSAI only based congestion activated in the AMF" but the UE-requested PDU session modification procedure is not exempt from S-NSSAI only based congestion control.

If the SMF receives an exemptionInd attribute indicating "message was exempted from the S-NSSAI only based congestion activated in the AMF" as specified in 3GPP TS 29.502 [20A], and the Extended protocol configuration options IE of the PDU SESSION MODIFICATION REQUEST message does not indicate 3GPP PS data off UE status, then the SMF shall set the 5GSM cause #69 "insufficient resources for specific slice" in the PDU SESSION MODIFICATION REJECT message.

g) 5G access network cannot forward the message.

If the SMF determines based on content of the n2SmInfo attribute specified in 3GPP TS 29.502 [20A] that the DL NAS TRANSPORT message carrying the PDU SESSION MODIFICATION COMMAND message was not forwarded to the UE by the 5G access network due to a cause other than handover procedure in progress, then the SMF shall reject the UE-requested PDU session modification procedure with an appropriate 5GSM cause value in the PDU SESSION MODIFICATION REJECT message.

NOTE: The use of an appropriate 5GSM cause value is implementation specific.

h) UE-requested MA PDU session modification with unspecified steering functionality and steering mode:

If the SMF receives the PDU SESSION MODIFICATION REQUEST message for an MA PDU session including the 5GSM capability information element that does not indicate support for any steering functionality or steering mode, the SMF shall reject the PDU session modification procedure with the 5GSM cause set to #95 "Semantically incorrect message" in the PDU SESSION MODIFICATION REJECT message.

6.4.3 UE-requested PDU session release procedure

6.4.3.1 General

The purpose of the UE-requested PDU session release procedure is to enable by the UE to request a release of a PDU session.

The UE is allowed to initiate the PDU session release procedure even if the timer T3396 is running.

The UE is allowed to initiate the PDU session release procedure even if the timer T3584 is running.

The UE is allowed to initiate the PDU session release procedure even if the timer T3585 is running.

The UE is allowed to initiate the PDU session release procedure even if the UE is outside the LADN service area.

6.4.3.2 UE-requested PDU session release procedure initiation

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

The UE may set the 5GSM cause IE of the PDU SESSION RELEASE REQUEST message to indicate the reason for releasing the PDU session.

The 5GSM cause IE typically indicates one of the following 5GSM cause values:

#26 insufficient resources;

#36 regular deactivation;

#44 Semantic errors in packet filter(s);

#45 Syntactical error in packet filter(s);

#83 Semantic error in the QoS operation;

#84 Syntactical error in the QoS operation;

#96 Invalid mandatory information.

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

The UE shall transport the PDU SESSION RELEASE REQUEST message and the PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5, and the UE shall start timer T3582 (see example in figure 6.4.3.2.1).

If the UE is releasing the PDU session due to:

a) errors in QoS operations or packet filters; or

b) the number of the authorized QoS rules, the number of the packet filters, or the number of the authorized QoS flow descriptions associated with the PDU session have reached the maximum number supported by the UE,

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

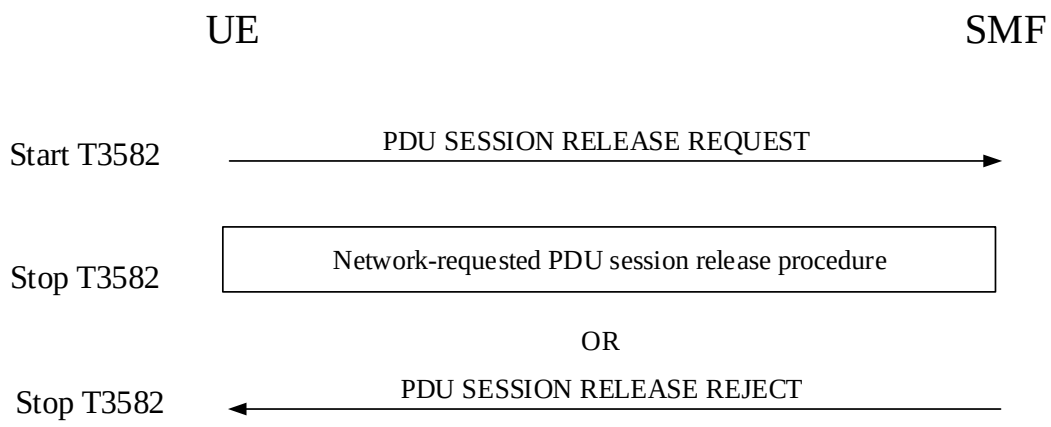


Figure 6.4.3.2.1: UE-requested PDU session release procedure

6.4.3.3 UE-requested PDU session release procedure accepted by the network

Upon receipt of a PDU SESSION RELEASE REQUEST message and a PDU session ID, if the SMF accepts the request to release the PDU session, and shall perform the network-requested PDU session release procedure as specified in subclause 6.3.3.

6.4.3.4 UE-requested PDU session release procedure not accepted by the network

Upon receipt of a PDU SESSION RELEASE REQUEST message, if the SMF does not accept the request to release the PDU session, the SMF shall create a PDU SESSION RELEASE REJECT message.

The SMF shall set the 5GSM cause IE of the PDU SESSION RELEASE REJECT message to indicate the reason for rejecting the PDU session release.

The 5GSM cause IE typically indicates one of the following SM cause values:

#35 PTI already in use; or

#43 Invalid PDU session identity; or

#95 – 111: protocol errors.

The SMF shall send the PDU SESSION RELEASE REJECT message.

Upon receipt of a PDU SESSION RELEASE REJECT message and a PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5, the UE shall stop timer T3582, release the allocated PTI value and locally release the PDU session. If there is one or more multicast MBS sessions associated with the PDU session, the UE shall locally leave the associated multicast MBS sessions.

6.4.3.5 Abnormal cases in the UE

The following abnormal cases can be identified:

a) Expiry of timer T3582.

The UE shall, on the first expiry of the timer T3582, retransmit the PDU SESSION RELEASE REQUEST message and the PDU session information which was transported together with the initial transmission of the PDU SESSION RELEASE REQUEST message and shall reset and start timer T3582. This retransmission is repeated four times, i.e. on the fifth expiry of timer T3582, the UE shall abort the procedure, release the allocated PTI, perform a local release of the PDU session, and perform the registration procedure for mobility and periodic registration update by sending a REGISTRATION REQUEST message including the PDU session status IE over each access that user plane resources have been established if the PDU session is an MA PDU session, or over the access the PDU session is associated with if the PDU session is a single access PDU session. If there is one or more multicast MBS sessions associated with the PDU session, the UE shall locally leave the associated multicast MBS sessions.

b) Collision of UE-requested PDU session release procedure and network-requested PDU session modification procedure.

When the UE receives a PDU SESSION MODIFICATION COMMAND message during the UE-requested PDU session release procedure, and the PDU session indicated in PDU SESSION MODIFICATION COMMAND message is the PDU session that the UE had requested to release, the UE shall ignore the PDU SESSION MODIFICATION COMMAND message and proceed with the PDU session release procedure.

c) Collision of UE-requested PDU session release procedure and network-requested PDU session release procedure.

When the UE receives a PDU SESSION RELEASE COMMAND message with the PTI IE set to "No procedure transaction identity assigned" during the UE-requested PDU session release procedure, the PDU session indicated in the PDU SESSION RELEASE COMMAND message is the same as the PDU session that the UE requests to release:

- if the Access type IE is included in the PDU SESSION RELEASE COMMAND message and the PDU session is an MA PDU session and having user-plane resources established on the access different from the access indicated in the Access type IE in the PDU SESSION RELEASE COMMAND message, the UE shall proceed both the UE-requested PDU session release procedure and network-requested PDU session release procedure; or

- otherwise, the UE shall abort the UE-requested PDU session release procedure and shall stop the timer T3582 and proceed with the network-requested PDU session release procedure.

NOTE 1: Whether the UE ignores the 5GSM cause #39 "reactivation requested" if received in the PDU SESSION RELEASE COMMAND is up to the UE implementation.

d) Receipt of an indication that the 5GSM message was not forwarded due to routing failure

Upon receiving an indication that the 5GSM message was not forwarded due to routing failure along with a PDU SESSION RELEASE REQUEST message with the PDU session ID IE set to the same value as the PDU session ID that was sent by the UE, the UE shall stop timer T3582, abort the procedure, release the allocated PTI, perform a local release of the PDU session, and perform the registration procedure for mobility and periodic registration update by sending a REGISTRATION REQUEST message including the PDU session status IE over each access that user plane resources have been established if the PDU session is an MA PDU session, or over the access the PDU session is associated with if the PDU session is a single access PDU session. If there is one or more multicast MBS sessions associated with the released PDU session, the UE shall locally leave the associated multicast MBS sessions.

e) PDU session release signalling restricted due to service area restriction

The UE may delay the release of the PDU session until the UE is not restricted by service area restrictions, or it may release the allocated PTI, perform a local release of the PDU session, and include the PDU session status IE over each access that user plane resources have been established if the PDU session is an MA PDU session, or over the access the PDU session is associated with if the PDU session is a single access PDU when performing the next registration procedure. If the UE performs the local release of the PDU session and there is one or more multicast MBS sessions associated with the released PDU session, the UE shall locally leave the associated multicast MBS sessions.

f) Collision of UE-requested PDU session release procedure and N1 NAS signalling connection release

The UE may immediately retransmit the PDU SESSION RELEASE REQUEST message and stop, reset and restart timer T3582, if the following conditions apply:

1) The original UE-requested PDU session release procedure was initiated over an existing N1 NAS signalling connection; and

2) the previous transmission of the PDU SESSION RELEASE REQUEST message was not initiated due to timer T3582 expiry.

g) Receipt of an indication that the 5GSM message was not forwarded due to the PLMN is not allowed to operate at the present UE location

Upon receiving an indication that the 5GSM message was not forwarded because the UE accessing via a satellite NG-RAN cell is informed that the PLMN is not allowed to operate at the present UE location along with a PDU SESSION RELEASE REQUEST message with the PDU session ID IE set to the same value as the PDU session ID that was sent by the UE, the UE shall stop timer T3582, abort the procedure and locally release the PDU session.

ga) Upon receiving an indication that the 5GSM message was not forwarded due to unexpected cause along with a PDU SESSION RELEASE REQUEST message with the PDU session ID IE set to the same value as the PDU session ID that was sent by the UE, the UE shall stop timer T3582, abort the procedure and locally release the PDU session.

6.4.3.6 Abnormal cases on the network side

The following abnormal cases can be identified:

a) PDU session inactive for the received PDU session identity.

If the PDU session ID in the PDU SESSION RELEASE REQUEST message belongs to any PDU session in state PDU SESSION INACTIVE in the SMF, the SMF shall send the PDU SESSION RELEASE REJECT message to the UE with the 5GSM cause #43 "Invalid PDU session identity".

6.5 5GSM status procedure

6.5.1 General

The purpose of the sending of the 5GSM STATUS message is to report at any time certain error conditions detected upon receipt of 5GSM protocol data. The 5GSM STATUS message can be sent by both the network and the UE (see example in figure 6.5.1.1).

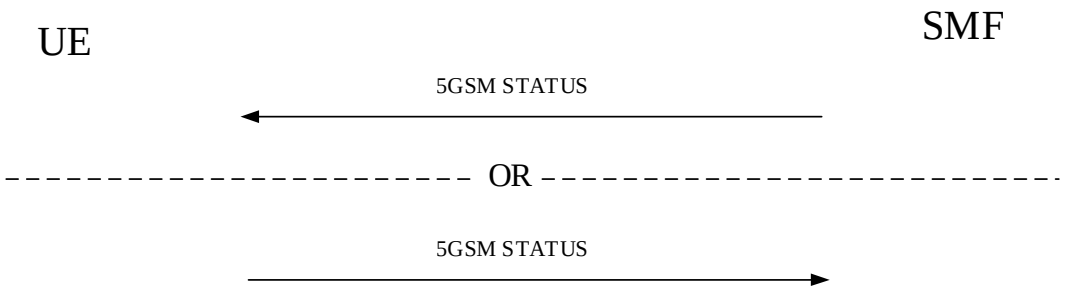


Figure 6.5.1.1: 5GSM status procedure

6.5.2 5GSM status received in the UE

If the 5GSM entity of the UE receives a 5GSM STATUS message the UE shall take different actions depending on the received 5GSM cause value:

#47 PTI mismatch.

The UE shall abort any ongoing 5GSM procedure related to the received PTI value and stop any related timer.

#81 invalid PTI value.

The UE shall abort any ongoing 5GSM procedure related to the received PTI value and stop any related timer.

#97 Message type non-existent or not implemented.

The UE shall abort any ongoing 5GSM procedure related to the PTI or PDU session ID and stop any related timer.

On receipt of a 5GSM STATUS message with any other 5GSM cause value no state transition and no specific action shall be taken as seen from the radio interface, i.e. local actions are possible.

6.5.3 5GSM status received in the SMF

If the SMF receives a 5GSM STATUS message the SMF shall take different actions depending on the received 5GSM cause value:

#43 invalid PDU session identity.

The SMF shall abort any ongoing 5GSM procedure related to the PTI or PDU session ID, stop any related timer and locally release the PDU session indicated in the 5GSM STATUS message.

#47 PTI mismatch.

The SMF shall abort any ongoing 5GSM procedure related to the received PTI value and stop any related timer.

If the PTI indicated in the 5GSM STATUS message is related to a PDU SESSION ESTABLISHMENT ACCEPT message, the SMF shall perform a local release of the PDU session indicated in the PDU SESSION ESTABLISHMENT ACCEPT message.

#81 invalid PTI value.

The SMF shall abort any ongoing 5GSM procedure related to the received PTI value and stop any related timer.

#96 invalid mandatory information.

The SMF shall abort any ongoing 5GSM procedure related to the PTI or PDU session ID and stop any related timer.

#97 message type non-existent or not implemented.

The SMF shall abort any ongoing 5GSM procedure related to the PTI or PDU session ID and stop any related timer.

The local actions to be taken by the SMF on receipt of a 5GSM STATUS message with any other 5GSM cause value are implementation dependent.

6.6 Miscellaneous procedures

6.6.1 Exchange of extended protocol configuration options

The UE and the SMF can exchange protocol configuration options via 5GSM procedures.

The protocol configuration options shall be exchanged via the Extended protocol configuration options IE.

6.6.2 Remote UE report procedure

6.6.2.1 General

The purpose of the 5G ProSe remote UE report procedure is for a UE acting as a 5G ProSe layer-3 UE-to-network UE relay to notify the network that a 5G ProSe remote UE is connected to the 5G ProSe layer-3 UE-to-network relay UE or disconnected from the 5G ProSe layer-3 UE-to-network relay UE as specified in 3GPP TS 23.304 [6E].

The UE does not initiate the remote UE report procedure if the timer T3396 is running.

The UE does not initiate the remote UE report procedure if the timer T3584 is running.

The UE does not initiate the remote UE report procedure if the timer T3585 is running.

6.6.2.2 Remote UE report procedure initiation

In order to initiate the 5G ProSe remote UE report procedure, the UE shall create a REMOTE UE REPORT message.

The UE shall include information of newly connected or disconnected 5G ProSe remote UEs to the network in the REMOTE UE REPORT message by setting the values of the Remote UE context connected IE or the Remote UE context disconnected IE to the 5G ProSe remote UE identities that are being connected or disconnected, respectively.

The UE shall set the Remote UE ID with:

a) the UP-PRUK ID of the 5G ProSe remote UE, if the security for 5G ProSe communication via 5G ProSe UE-to-network relay is performed over user plane as specified in 3GPP TS 33.503 [56];

b) the CP-PRUK ID of the 5G ProSe remote UE, if the security for 5G ProSe communication via 5G ProSe UE-to-network relay is performed over control plane as specified in 3GPP TS 33.503 [56]; or

c) the PEI of the 5G ProSe remote UE, if the RSC is specific for emergency services as specified in 3GPP TS 24.554 [19E], and the 5G ProSe remote UE is identified by a PEI.

If the UE sets the Remote UE ID with the PRUK ID of the 5G ProSe remote UE and the UP-PRUK ID is in 64-bit string format, the UE shall include the HPLMN ID of the 5G ProSe remote UE.

If the UE allocated an IPv4 address to a 5G ProSe remote UE and enabled UDP usage to the 5G ProSe remote UE, the UE shall include in the REMOTE UE REPORT message the UDP port range assigned to the 5G ProSe remote UE in the NAT function of 5G ProSe layer-3 UE-to-network relay. If the UE allocated an IPv4 address to a 5G ProSe remote UE and enabled TCP usage to the 5G ProSe remote UE, the UE shall include in the REMOTE UE REPORT message the TCP port range assigned to the 5G ProSe remote UE in the NAT function of 5G ProSe layer-3 UE-to-network relay.

The UE shall set the PDU session ID IE to the value of the PDU session associated with the 5G ProSe remote UE connected to the 5G ProSe layer-3 UE-to-network relay UE or disconnected from the 5G ProSe layer-3 UE-to-network relay UE.

The UE shall allocate a PTI value currently not used and shall set the PTI IE of the REMOTE UE REPORT message to the allocated PTI value.

The UE shall transport the REMOTE UE REPORT message and the PDU session ID, using the NAS transport procedure as specified in subclause 5.4.5, and the UE shall start timer T3586 (see example in figure 6.6.2.2.1).

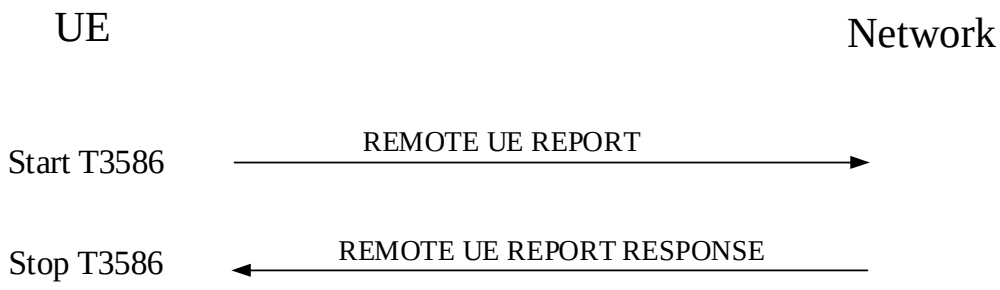


Figure 6.6.2.2.1: Remote UE report procedure

6.6.2.3 Remote UE report procedure accepted by the network

Upon receipt of the REMOTE UE REPORT message, the SMF shall send a REMOTE UE REPORT RESPONSE message to the UE. The SMF shall include the PTI from the REMOTE UE REPORT message.

The SMF shall set the EAP message IE to an EAP-success message or an EAP-failure message to be sent to the 5G ProSe layer-3 remote UE if the EAP-success message or the EAP-failure message is received from the DN.

Upon receipt of the REMOTE UE REPORT RESPONSE message, the UE shall stop timer T3586 and enter the state PROCEDURE TRANSACTION INACTIVE.

6.6.2.4 Abnormal cases in the UE

The following abnormal cases can be identified:

a) Expiry of timer T3586:

On the first expiry of the timer T3586, the UE shall resend the REMOTE UE REPORT message and shall reset and restart timer T3586. This retransmission is repeated two times, i.e. on the third expiry of timer T3586, the UE shall abort the procedure and release any resources for this procedure.

NOTE: After the abortion of the remote UE report procedure, the remote UE report procedure for the remote UE(s) can be restarted and how to restart the procedure is left to UE implementation.

b) Collision of network-requested PDU session release procedure and remote UE report procedure:

If the UE receives a PDU SESSION RELEASE COMMAND message during the remote UE report procedure, and the PDU session indicated in the PDU SESSION RELEASE COMMAND message is the PDU session ID that the UE had indicated in the REMOTE UE REPORT message, the UE shall abort the remote UE report procedure and proceed with the network-requested PDU session release procedure.