**3GPP TSG-CT WG1 Meeting #122eC1-200aaa**

**Electronic meeting, 20-28 February 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **24.501** | **CR** | **1672** | **rev** | **1** | **Current version:** | **16.3.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network |  | Core Network | **x** |

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| ***Title:*** | Handling of user-plane resources for NB-IoT UEs having at least two PDU sessions | | | | | | | | | |
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| ***Source to WG:*** | Qualcomm Incorporated | | | | | | | | | |
| ***Source to TSG:*** | C1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | 5G\_CIoT | | | | |  | ***Date:*** | | | 2019-10-21 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **C** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
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| ***Reason for change:*** | | In TS 23.502 v16.3.0, subclause 4.3.2.2.1, SA2 has agreed on adding the following text:  *If the AMF determines that the RAT type is NB-IoT and the UE has already 2 PDU Sessions with user plane resources activated, the AMF may either reject the PDU Session Establishment Request or continue with the PDU Session establishment and include the Control Plane CIoT 5GS Optimisation indication or Control Plane Only indicator to the SMF.*  This requirement needs to be reflected in TS 24.501 in the addition to enforcing the establishment of user-plane resources for a maximum of 2 PDU sessions during a service request procedure. | | | | | | | | |
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| ***Summary of change:*** | | 1) In the general section for CIoT 5GS optimization (i.e. section 5.3.21), it is clarified that the AMF may either reject a 5GSM request for a new PDU session or forward the request to the SMF and indicate that the session is for control-plane CIoT 5GS optimization (based on AMF implementation).  2) If the AMF decides to reject the 5GSM request, the AMF sends back the 5GSM message to the UE in the DL NAS TRANSPORT message and includes 5GMM cause #92 "payload was not forwarded". It is suggested to re-use this existing cause to handle such a scenario. For this, changes are introduced in section 5.4.5.2.4.  2) During a service request procedure, the AMF does not establish the user-plane resources if the NB-IoT UE already has active user-plane resources for 2 other PDU sessions. If the AMF includes the PDU session reactivation result error cause IE, then it shall be set to the 5GMM cause #92 "insufficient user-plane resources for the PDU session". For this, changes are introduced in section 5.6.1.4.2.  Furthermore, the conditions defined section in 5.6.1.4.1 for including the PDU session reactivation result error cause IE have been copied into section 5.6.1.4.2 to have a consistent text. | | | | | | | | |
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| ***Consequences if not approved:*** | | No enforcement mechanism for the maximum number of PDU sessions with UP resources for Ue using CP CIoT optimizations. User experience will be degraded. | | | | | | | | |
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| ***Clauses affected:*** | | 5.3.21, 5.4.5.2.4, 5.6.1.2.2, 5.6.1.4.1, 5.6.1.4.2 | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
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| ***This CR's revision history:*** | | Rev 1: reflects new baseline version 16.3.0 of the spec | | | | | | | | |

\*\*\*\*\* Next change \*\*\*\*\*

### 5.3.21 CIoT 5GS optimizations

CIoT 5GS optimizations provide improved support of small data and SMS transfer. A UE supporting CIoT 5GS optimizations can indicate the 5GS CIoT network behaviour the UE can support and prefers to use during the registration procedure (see 3GPP TS 23.502 [9]). The UE may indicate the support for control plane CIoT 5GS optimization, user plane CIoT 5GS optimization, N3 data transfer and header compression (see subclause 9.11.3.1). Furthermore, the UE may, separately from the indication of support, indicate preference for control plane CIoT 5GS optimization or user plane CIoT 5GS optimization (see subclause 9.11.3.9A). The indication of preference is also considered as the request to use. A UE supporting CIoT EPS optimizations can also indicate the EPS CIoT network behaviour the UE can support during the registration procedure. Furthermore, the UE may, separately from the indication of support, indicate preference for control plane CIoT EPS optimization or user plane CIoT EPS optimization.

NOTE 1: CIoT 5GS optimizations are not supported by NR connected to 5GCN.

NOTE 2: If the UE does not support user plane CIoT 5GS optimization, it does not indicate preference for user plane CIoT 5GS optimization.

The UE can be in NB-N1 mode or WB-N1 mode when requesting the use of CIoT 5GS optimizations during the registration procedure. A UE in NB-N1 mode always indicates support for control plane CIoT 5GS optimization.

In NB-N1 mode, the UE, when requesting the use of CIoT 5GS optimizations, does not:

- request an initial registration for emergency services;

- request a PDU session establishment for emergency PDU session; or

- indicate UE's usage setting during the registration procedure.

The network does not indicate to the UE support of emergency services when the UE is in NB-N1 mode (see subclause 5.5.1.2.4 and 5.5.1.3.4).

The control plane CIoT 5GS optimization enables support of efficient transport of user data (IP, Ethernet and Unstructured) or SMS messages over control plane via the AMF without triggering user-plane resources establishment. The support of control plane CIoT 5GS optimization is mandatory for the network in NB-N1 mode and optional in WB-N1 mode. Optional header compression of IP data and Ethernet data can be applied to PDU sessions with IP PDU session type and Ethernet PDU session type that are configured to support header compression.

For a UE that supports Location Services (LCS) notification mechanisms in N1 mode, the control plane CIoT 5GS optimization also enables the transport of location services messages from 5GMM-IDLE mode using the CONTROL PLANE SERVICE REQUEST message when location services are requested (see subclause 6.7.1 in 3GPP TS 23.273 [6B]).

The user plane CIoT 5GS optimization enables support for change from 5GMM-IDLE mode over 3GPP access to 5GMM-CONNECTED mode over 3GPP access without the need for using the service request procedure (see subclause 5.3.1.5).

If the UE supports user plane CIoT 5GS optimization, it shall also support N3 data transfer.

If the UE indicates support of one or more CIoT 5GS optimizations and the network supports one or more CIoT 5GS optimizations and decides to accept the registration request, the network indicates the supported CIoT 5GS optimizations to the UE per registration area when accepting the UE request. Network indication of support is interpreted by the UE as the acceptance to use the respective feature. After completion of the registration procedure, the UE and the network can then use the accepted CIoT 5GS optimizations for the transfer of user data (IP, Ethernet, Unstructured and SMS).

A UE in NB-N1 mode or WB-N1 mode can request the use of SMS over NAS by setting the SMS requested bit of the 5GS update type IE in the REGISTRATION REQUEST message as specified in subclauses 5.5.1.2.2 and 5.5.1.3.2.

The AMF indicates whether it allows the use of SMS over NAS for a UE in NB-N1 mode or WB-N1 mode by setting the SMS allowed bit of the 5GS registration result IE in the REGISTRATION ACCEPT message as specified in subclauses 5.5.1.2.4 and 5.5.1.3.4.

If the UE and the network support both the control plane CIoT 5GS optimization and N3 data transfer, then when receiving the UE's request for a PDU session establishment, the AMF decides whether the PDU session should be NEF PDU session or N6 PDU session as specified in 3GPP TS 23.501 [8] and then:

a) if NEF PDU session is to be established for unstructured data type, the AMF includes Control plane only indication for the requested PDU session to the SMF;

b) if N6 PDU session is to be established and the DNN or S-NSSAI of the newly requested N6 PDU session supports interworking with EPS as specified in TS 23.502 [9]:

1) if there are existing N6 PDU sessions supporting interworking with EPS for this UE that were established with the Control plane only indication, the AMF includes the Control plane only indication for the newly requested N6 PDU session to the SMF; or

2) if there are existing N6 PDU sessions supporting interworking with EPS for this UE that were established without the Control plane only indication, the AMF does not include the Control plane only indication for the newly requested N6 PDU session to the SMF;

3) if there is no existing N6 PDU session supporting interworking with EPS for this UE, the AMF determines whether to include the Control plane only indication for the newly requested N6 PDU session to the SMF based on local policies, the UE's preferred CIoT network behaviour and the supported CIoT network behaviour; and

c) if N6 PDU session is to be established and the DNN or S-NSSAI of the N6 PDU session does not support interworking with EPS as specified in TS 23.502 [9], the AMF determines whether to include the Control plane only indication for the newly requested N6 PDU session to the SMF based on local policies, the UE's preferred CIoT network behaviour and the supported CIoT network behaviour.

In NB-N1 mode, if the UE or the network does not support N3 data transfer, then when receiving the UE's request for a PDU session establishment, the AMF decides whether the PDU session should be NEF PDU session or N6 PDU session as specified in 3GPP TS 23.501 [8] and then includes the Control plane only indication for the requested PDU session to the SMF.

If the network supports user plane CIoT 5GS optimization, it shall also support N3 data transfer.

Broadcast system information may provide information about support of CIoT 5GS optimizations (see 3GPP TS 36.331 [25A]). At reception of new broadcast system information, the lower layers deliver it to the 5GMM layer in the UE. The information provided by lower layers is per PLMN and used by the UE to determine whether certain CIoT 5GS optimizations are supported in the cell.

The UE shall not attempt to use CIoT 5GS optimizations which are indicated as not supported.

In NB-N1 mode, at any given time, there cannot be user-plane resources established for more than two PDU sessions. The UE in NB-N1 mode shall not:

a) request the establishment of user-plane resources for more than two PDU sessions; or

b) initiate the establishment of a new PDU session if:

1) the UE has indicated preference for user plane CIoT 5GS optimization;

2) the network accepted the use of user plane CIoT 5GS optimization; and

3) the UE currently has user-plane resources established for two other PDU sessions.

When a UE in NB-N1 mode for which the network has accepted the use of user plane CIoT 5GS optimization:

a) has user-plane resources established for two PDU sessions; and

b) requests the establishment of a new PDU session;

the AMF either rejects the PDU session establishment request or proceeds with the PDU Session establishment and includes the Control Plane CIoT 5GS Optimisation indication or Control Plane Only indicator to the SMF.

A PDU session for a UE in NB-N1 mode shall only have one QoS rule and that is the default QoS rule. Reflective QoS is not supported in NB-N1 mode.

In NB-N1 mode, when the UE requests the lower layer to establish a RRC connection and the UE requests the use of user plane CIoT 5GS optimization, the UE shall pass an indication of the requested CIoT 5GS optimizations to the lower layers. If the UE requests the use of N3 data transfer without user plane CIoT 5GS optimization, then the UE shall also pass an indication of user plane CIoT 5GS optimization to lower layers.

In WB-N1 mode, when the UE requests the lower layer to establish a RRC connection and the UE requests the use of control plane CIoT 5GS optimization or user plane CIoT 5GS optimization, the UE shall pass an indication of the requested CIoT 5GS optimizations to the lower layers.

\*\*\*\*\* Next change \*\*\*\*\*

##### 5.4.5.2.4 UE-initiated NAS transport of messages not accepted by the network

Upon reception of an UL NAS TRANSPORT message, if the Payload container type IE is set to "N1 SM information" and the UE is not configured for high priority access in selected PLMN, and:

a) if the Request type IE is set to "initial request" or "existing PDU session";

1) DNN based congestion control is activated for the DNN included in the UL NAS TRANSPORT message, or DNN based congestion control is activated for the selected DNN in case of no DNN included in the UL NAS TRANSPORT message, e.g. configured by operation and maintenance, the AMF shall send back to the UE the 5GSM message which was not forwarded, a back-off timer value and 5GMM cause #22 "congestion" as specified in subclause 5.4.5.3.1 case f);

2) S-NSSAI and DNN based congestion control is activated for the S-NSSAI and DNN included in the UL NAS TRANSPORT message, or S-NSSAI and DNN based congestion control is activated for the S-NSSAI included in the UL NAS TRANSPORT message and the selected DNN in case of no DNN included in the UL NAS TRANSPORT message, or S-NSSAI and DNN based congestion control is activated for the selected S-NSSAI in case of no S-NSSAI included in the UL NAS TRANSPORT message and the DNN included in the UL NAS TRANSPORT message, or S-NSSAI and DNN based congestion control is activated for the selected S-NSSAI and the selected DNN in case of no S-NSSAI and no DNN included in the UL NAS TRANSPORT message, e.g. configured by operation and maintenance, the AMF shall send back to the UE the 5GSM message which was not forwarded, a back-off timer value and 5GMM cause #67 "insufficient resources for specific slice and DNN" as specified in subclause 5.4.5.3.1 case f);

3) S-NSSAI only based congestion control is activated for the S-NSSAI included in the UL NAS TRANSPORT message, or S-NSSAI based congestion control is activated for the selected S-NSSAI in case of no S-NSSAI included in the UL NAS TRANSPORT message, e.g. configured by operation and maintenance, the AMF shall send back to the UE the 5GSM message which was not forwarded, a back-off timer value and 5GMM cause #69 "insufficient resources for specific slice" as specified in subclause 5.4.5.3.1 case f);

b) if the Request type IE is set to "MA PDU request";

1) DNN based congestion control is activated for the DNN included in the UL NAS TRANSPORT message, or DNN based congestion control is activated for the selected DNN in case of no DNN included in the UL NAS TRANSPORT message, e.g. configured by operation and maintenance, the AMF shall send back to the UE the 5GSM message which was not forwarded, a back-off timer value and 5GMM cause #22 "congestion" as specified in subclause 5.4.5.3.1 case f);

2) S-NSSAI and DNN based congestion control is activated for the S-NSSAI and DNN included in the UL NAS TRANSPORT message, or S-NSSAI and DNN based congestion control is activated for the S-NSSAI included in the UL NAS TRANSPORT message and the selected DNN in case of no DNN included in the UL NAS TRANSPORT message, or S-NSSAI and DNN based congestion control is activated for the selected S-NSSAI in case of no S-NSSAI included in the UL NAS TRANSPORT message and the DNN included in the UL NAS TRANSPORT message, or S-NSSAI and DNN based congestion control is activated for the selected S-NSSAI and the selected DNN in case of no S-NSSAI and no DNN included in the UL NAS TRANSPORT message, e.g. configured by operation and maintenance, the AMF shall send back to the UE the 5GSM message which was not forwarded, a back-off timer value and 5GMM cause #67 "insufficient resources for specific slice and DNN" as specified in subclause 5.4.5.3.1 case f);

3) S-NSSAI only based congestion control is activated for the S-NSSAI included in the UL NAS TRANSPORT message, or S-NSSAI based congestion control is activated for the selected S-NSSAI in case of no S-NSSAI included in the UL NAS TRANSPORT message, e.g. configured by operation and maintenance, the AMF shall send back to the UE the 5GSM message which was not forwarded, a back-off timer value and 5GMM cause #69 "insufficient resources for specific slice" as specified in subclause 5.4.5.3.1 case f);

c) if the Request type IE is set to "modification request" and the PDU session is not an emergency PDU session;

1) DNN based congestion control is activated for the stored DNN, e.g. configured by operation and maintenance, the AMF shall send back to the UE the 5GSM message which was not forwarded, a back-off timer value and 5GMM cause #22 "congestion" as specified in subclause 5.4.5.3.1 case f);

2) S-NSSAI and DNN based congestion control is activated for the stored S-NSSAI and DNN, e.g. configured by operation and maintenance, the AMF shall send back to the UE the 5GSM message which was not forwarded, a back-off timer value and 5GMM cause #67 "insufficient resources for specific slice and DNN" as specified in subclause 5.4.5.3.1 case f);

3) S-NSSAI only based congestion control is activated for the stored S-NSSAI, e.g. configured by operation and maintenance, the AMF shall send back to the UE the 5GSM message which was not forwarded, a back-off timer value and 5GMM cause #69 "insufficient resources for specific slice" as specified in subclause 5.4.5.3.1 case f); or

d) the timer T3447 is running and the UE does not support service gap control:

1) the current NAS signalling connection was not triggered by paging; and

2) mobile terminated signalling has not been sent or no user-plane resources have been established for any PDU session after the establishment of the current NAS signalling connection,

the AMF shall send back to the UE the message which was not forwarded, send the 5GMM cause #22 "Congestion", and may include a back-off timer set to the remaining time of the timer T3447 as specified in subclause 5.4.5.3.1 case f).

Upon reception of a UL NAS TRANSPORT message, if the Payload container type IE is set to "N1 SM information", the Request type IE is set to "initial request", "existing PDU session" or "MA PDU request", and the AMF determines that the PLMN's maximum number of PDU sessions has already been reached for the UE, the AMF shall send back to the UE the 5GSM message which was not forwarded and 5GMM cause #65 "maximum number of PDU sessions reached" as specified in subclause 5.4.5.3.1 case h).

Upon reception of a UL NAS TRANSPORT message, if the Payload container type IE is set to "N1 SM information", the Request type IE is set to "initial request", and

a) the UE is in NB-N1 mode;

b) the UE has indicated preference for user plane CIoT 5GS optimization;

c) the network accepted the use of user plane CIoT 5GS optimization; and

d) the AMF:

1) determines that there are user-plane resources established for two other PDU sessions for this UE (see 3GPP TS 23.501 [8]); and

2) decides to not forward the 5GSM message to the SMF (see 3GPP TS 23.502 [9]);

the AMF shall send back to the UE the message which was not forwarded and 5GMM cause #90 "payload was not forwarded" as specified in subclause 5.4.5.3.1 case e).

Upon reception of an UL NAS TRANSPORT message, if the Payload container type IE is set to "CIoT user data container", the UE is not configured for high priority access in selected PLMN, and:

a) the timer T3447 is running and the UE does not support service gap control;

b) the current NAS signalling connection was not triggered by paging; and

c) mobile terminated signalling has not been sent over the current NAS signalling connection;

the AMF shall send back to the UE the CIoT user data which was not forwarded, send the 5GMM cause #22 "Congestion", and include a back-off timer set to the remaining time of the timer T3447 as specified in subclause 5.4.5.3.1 case l2).

Upon reception of an UL NAS TRANSPORT message, if the Payload container type IE is set to "SMS" or "LTE Positioning Protocol (LPP) message container", the UE is not configured for high priority access in selected PLMN, and:

a) the timer T3447 is running and the UE does not support service gap control;

b) the current NAS signalling connection was not triggered by paging; and

c) mobile terminated signalling has not been sent or no user-plane resources have been established for any PDU session after the establishment of the current NAS signalling connection;

the AMF shall abort the procedure.

NOTE: In this state the NAS signaling connection can be released by the network.

\*\*\*\*\* Next change \*\*\*\*\*

##### 5.6.1.2.2 UE is using 5GS services with control plane CIoT 5GS optimization

The UE shall send a CONTROL PLANE SERVICE REQUEST message, start T3517 and enter the state 5GMM-SERVICE-REQUEST-INITIATED.

For case a in subclause 5.6.1.1, the Control plane service type of the CONTROL PLANE SERVICE REQUEST message shall indicate "mobile terminating request". If the UE only has uplink user data or SMS to be sent, the UE shall:

a) if the data size is not more than 254 octets and there is no other optional IE to be included in the message,

1) for sending data, set the Data type field to "control plane user data", include the PDU session ID, data, and Downlink data expected (DDX) (if available), in the CIoT small data container IE; and

2) for sending SMS, set the Data type field to "SMS", include SMS in the CIoT small data container IE; and

b) otherwise if the data size is more than 254 octets or there are other optional IEs to be included in the message, set the Payload container type IE to "CIoT user data container", include data in the Payload container IE as described in subclause 5.4.5.2.2.

NOTE 1: The term DDX used in the present document corresponds to the term NAS RAI used in 3GPP TS 23.502 [9].

For case c, and case d if the UE has pending user data that is to be sent via the control plane in subclause 5.6.1.1, the UE shall set the Control plane service type of the CONTROL PLANE SERVICE REQUEST message to "mobile originating request". If the UE has only uplink user data or SMS to be sent, the UE shall:

a) if the data size is not more than 254 octets, there is no other optional IE to be included in the CONTROL PLANE SERVICE REQUEST message, and the data being sent is:

1) CIoT user data, set the Data type field to "control plane user data", include the PDU session ID, data, and Downlink data expected (DDX) (if available), in the CIoT small data container IE;

2) location services message, set the Data type field to "Location services message container" and Downlink data expected (DDX), if available, in the CIoT small data container IE, and:

i) if routing information is provided by upper layers:

A) set the length of additional information field in the CIoT small data container IE to the length of routing information provided by upper layer location services application (see subclause 9.11.3.67), and set the additional information field in the CIoT small data container IE to the routing information provided by upper layer location services application (see subclause 9.11.3.67); or

B) otherwise set the length of additional information field in the CIoT small data container IE to zero. In this case the Additional information field of the CIoT small data container IE shall not be included; and

ii) set the Data contents field of the CIoT small data container IE to the location services message payload; or

3) SMS, set the Data type field to "SMS", include SMS in the CIoT small data container IE; or

b) otherwise if the data size is more than 254 octets or there are other optional IEs to be included in the CONTROL PLANE SERVICE REQUEST message, and the data being sent is:

1) CIoT user data, set the Payload container type IE to "CIoT user data container", include data in the Payload container IE as described in subclause 5.4.5.2.2;

2) location services message, set the Payload container type IE to "Location services message container", include data in the Payload container IE as described in subclause 5.4.5.2.2. If the upper layer location services application provides the routing information set the Additional information IE to the routing information as described in subclause 5.4.5.2.2; or

3) SMS, set the Payload container type IE to "SMS" and include data in the Payload container IE as described in subclause 5.4.5.2.2.

For case a, if the UE has pending user data that is to be sent via the user plane in subclause 5.6.1.1, the UE shall set the Control plane service type of the CONTROL PLANE SERVICE REQUEST message to "mobile terminating request". The UE shall include the Uplink data status IE in the CONTROL PLANE SERVICE REQUEST message to indicate which PDU session(s) have pending user data to be sent via user-plane resources.

For case d, if the UE has pending user data that is to be sent via the user plane in subclause 5.6.1.1, the UE shall set the Control plane service type of the CONTROL PLANE SERVICE REQUEST message to "mobile originating request". The UE shall include the Uplink data status IE in the CONTROL PLANE SERVICE REQUEST message to indicate which PDU session(s) have pending user data to be sent via user-plane resources.

NOTE 2: For a UE in NB-N1 mode, the Uplink data status IE cannot be used to request the establishment of user-plane resources such that there will be user-plane resources established for more than two PDU sessions.

\*\*\*\*\* Next change \*\*\*\*\*

##### 5.6.1.4.2 UE is using 5GS services with control plane CIoT 5GS optimization

For case a in subclause 5.6.1.1, upon receipt of the CONTROL PLANE SERVICE REQUEST message with Control plane service type indicating "mobile terminating request", after completion of the 5GMM common procedures (if initiated) according to subclause 5.6.1.3, the AMF shall send a SERVICE ACCEPT message.

For case c and d in subclause 5.6.1.1, upon receipt of the CONTROL PLANE SERVICE REQUEST message with Control plane service type indicating "mobile originating request", after completion of the 5GMM common procedures (if initiated) according to subclause 5.6.1.3, the AMF shall send a SERVICE ACCEPT message, except for case d when the DDX field of the Release assistance indication IE or the DDX field of the CIoT small data container IE indicates "No further uplink and no further downlink data transmission subsequent to the uplink data transmission is expected".

For case a, c and d:

a) if the CIoT small data container IE is included in the message, the AMF shall:

1) if the Data type field indicates "control plane user data", extract the PDU session ID and data content from the CIoT small data container IE, look up a PDU session routing context for the UE, and forward the content of the CIoT small data container IE to the SMF associated with the UE;

2) if the Data type field indicates "SMS", forward the content of the CIoT small data container IE to the SMSF associated with the UE; or

3) if the Data type field indicates "Location services message container", and if

i) length of additional information field in the CIoT small data container IE is zero, forward the value of Data type field and the content of the CIoT small data container IE to the to the location services application; or

ii) otherwise forward the value of Data type field and the content of the CIoT small data container IE to the LMF associated with the routing information that is included in the additional information field of the CIoT small data container IE; or

b) otherwise;

1) if the Payload container IE is included in the CONTROL PLANE SERVICE REQUEST message and if the Payload container type IE is set to "CIoT user data container", the AMF shall forward the content of the Payload container IE to the SMF associated with the UE;

2) if the Payload container IE is included in the CONTROL PLANE SERVICE REQUEST message and if the Payload container type IE is set to "SMS", the AMF shall forward the content of the Payload container IE to the SMSF associated with the UE;

3) if the PDU session status IE is included in the CONTROL PLANE SERVICE REQUEST message or the AMF needs to perform a PDU session status synchronization, the AMF shall include a PDU session status IE in the SERVICE ACCEPT message to indicate which PDU sessions associated with the access type the SERVICE ACCEPT message is sent over are active in the AMF.

4) If the Uplink data status IE is included in the CONTROL PLANE SERVICE REQUEST message and does not indicate a request to have user-plane resources established for more than two PDU sessions for a UE in NB-N1 mode, the AMF shall:

i) indicate the SMF to re-establish the user-plane resources for the corresponding PDU sessions; and

ii) include the PDU session reactivation result IE in the SERVICE ACCEPT message to indicate the user-plane resources re-establishment result of the PDU sessions for which the UE requested to re-establish the user-plane resources.

5) Otherwise, if the Uplink data status IE is included in the SERVICE REQUEST and indicates a request to have user-plane resources established for more than two PDU sessions for a UE in NB-N1 mode, the AMF shall not indicate to the SMF to re-establish the user-plane resources for the corresponding PDU sessions; and

6) if the Payload container IE is included in the message and if the Payload container type IE is set to "Location services message container", the AMF shall forward the Payload container type and the content of the Payload container IE to the LMF associated with the routing information included in the Additional information IE of the CONTROL PLANE SERVICE REQUEST message.

If the DDX field in the CIoT small data container IE or the Release assistance indication IE indicates "No further uplink and no further downlink data transmission subsequent to the uplink data transmission is expected", the AMF initiates the release of the N1 NAS signalling connection (see 3GPP TS 23.502 [9]).

Upon successful completion of the procedure, the UE shall reset the service request attempt counter, stop the timer T3517 and enter the state 5GMM-REGISTERED.

If the PDU session status information element is included in the SERVICE ACCEPT message, then the UE shall perform a local release of all those PDU sessions which are active on the UE side associated with the 3GPP access but are indicated by the AMF as being inactive.

If the user-plane resources cannot be established for a PDU session, the AMF shall include the PDU session reactivation result IE in the SERVICE ACCEPT message indicating that user-plane resources for the corresponding PDU session cannot be re-established, and shall include the PDU session reactivation result error cause IE with the 5GMM cause set to:

a) #43 "LADN not available" if the user-plane resources cannot be established because the SMF indicated to the AMF that the UE is located out of the LADN service area (see 3GPP TS 29.502 [20A]);

b) #28 "restricted service area" if the user-plane resources cannot be established because the SMF indicated to the AMF that only prioritized services are allowed (see 3GPP TS 29.502 [20A]); or

c) #92 "insufficient user-plane resources for the PDU session" if:

1) the user-plane resources cannot be established because the SMF indicated to the AMF that the resource is not available in the UPF (see 3GPP TS 29.502 [20A]); or

2) the UE is in NB-N1 mode and the result will lead to user-plane resources established for more than two PDU sessions (see 3GPP TS 23.502 [9]).

NOTE: For a UE that is not in NB-N1 mode, it is up to UE implementation when to re-send a request for user-plane re-establishment for the associated PDU session after receiving a PDU session reactivation result error cause IE with a 5GMM cause set to #92 "insufficient user-plane resources for the PDU session".

For case d) in subclause 5.6.1.1, the UE shall also treat the indication from the lower layers that the RRC connection has been released as successful completion of the procedure. The UE shall reset the service request attempt counter, stop the timer T3517 and enter the state 5GMM-REGISTERED.

Editor's note: abnormal cases for the CONTROL PLANE SERVICE REQUEST on the UE and network side are FFS.

If the AMF sends a SERVICE ACCEPT message upon receipt of the CONTROL PLANE SERVICE REQUEST message with uplink data:

- if the UE has indicated support for the control plane CIoT 5GS optimizations; and

- if the AMF decides to activate the congestion control for transport of user data via the control plane,

then the AMF shall include the T3448 value IE in the SERVICE ACCEPT message.

If the T3448 value IE is present in the received SERVICE ACCEPT message and the value indicates that this timer is neither zero nor deactivated, the UE shall:

a) stop timer T3448 if it is running;

b) consider the transport of user data via the control plane as successful; and

c) start timer T3448 with the value provided in the T3448 value IE.

If the UE is using 5GS services with control plane CIoT 5GS optimization, the T3448 value IE is present in the SERVICE ACCEPT message and the value indicates that this timer is either zero or deactivated, the UE shall consider this case as an abnormal case and proceed as if the T3448 value IE was not present.

If the UE in 5GMM-IDLE mode initiated the service request procedure by sending a CONTROL PLANE SERVICE REQUEST message and the SERVICE ACCEPT message does not include the T3448 value IE and if timer T3448 is running, then the UE shall stop timer T3448.