**3GPP TSG-RAN WG2 Meeting #112-e  *draft\_R2-20010811***

**Online, 2nd - 13th November 2020**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
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|  | **36.300** | **CR** | **1299** | **rev** |  **2** | **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 | **X** | Core Network |  |

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| ***Title:***  | Clarification to completion of UP-EDT procedure when using RLC AM  |
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| ***Source to WG:*** | Huawei, HiSilicon |
| ***Source to TSG:*** | R2 |
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| ***Work item code:*** | NB\_IOTenh2-Core, LTE\_eMTC4-Core |  | ***Date:*** | 2020-11-xx |
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| ***Category:*** | **A** |  | ***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 canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-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:*** | RAN2 has agreed that the EDT procedure terminates with the reception of a HARQ ACK of MSG4 acknowledging the successful downlink transmission that contains *RRCConnectionRelease*. |
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| ***Summary of change:*** | Capture in section 7.3b.3 that the procedure ends with the reception of the HARQ ACK acknowledging the successful DL that contains RCConnectionRelease, regardless of whether the RLC poll bit is set or not.**Impact analysis**Impacted functionality: UP-EDTInter-operability:If the UE is implemented according to the CR and the NW is not, then the UE may not send a RLC STATUS when the NW has set the poll bit and the NW concludes that the DL data were not successfully delivered.If the NW is implemented according to the CR and the UE is not, there is no interoperability issue. |
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| ***Consequences if not approved:*** | The specification is not clear regarding completion of EDT procedure when RLC AM is used. |
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| ***Clauses affected:*** | 7.3b.3 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** | Functionally, this a shadow CR of Rel-15 CR 1298. However, it applies also to MT-EDT and Transmission using PUR. |
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| ***This CR's revision history:*** |  |

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| Start of change |

### 7.3b.3 MO-EDT for User Plane CIoT EPS/5GS optimisations

MO-EDT for User Plane CIoT EPS optimisation, as defined in TS 24.301 [20], and for User Plane CIoT 5GS Optimisation, as defined in TS 24.501 [91], are characterized as below:

- The UE has been provided with a *NextHopChainingCount* in the *RRCConnectionRelease* message with suspend indication;

- Uplink user data are transmitted on DTCH multiplexed with UL *RRCConnectionResumeRequest* message on CCCH;

- Downlink user data are optionally transmitted on DTCH multiplexed with DL *RRCConnectionRelease* message on DCCH;

- The short resume MAC-I is reused as the authentication token for *RRCConnectionResumeRequest* message and is calculated using the integrity key from the previous connection;

- The user data in uplink and downlink are ciphered. The keys are derived using the *NextHopChainingCount* provided in the *RRCConnectionRelease* message of the previous RRC connection;

- The *RRCConnectionRelease* message is integrity protected and ciphered using the newly derived keys;

- There is no transition to RRC CONNECTED.

The MO-EDT procedure for User Plane CIoT EPS optimisation is illustrated in Figure 7.3b-2.



Figure 7.3b-2: MO-EDT for User Plane CIoT EPS Optimisation

0. Upon connection resumption request for Mobile Originated data from the upper layers, the UE initiates the MO-EDT procedure and selects a random access preamble configured for EDT.

1. The UE sends an *RRCConnectionResumeRequest* to the eNB, including its Resume ID, the establishment cause, and an authentication token. The UE resumes all SRBs and DRBs, derives new security keys using the *NextHopChainingCount* provided in the *RRCConnectionRelease* message of the previous RRC connection and re-establishes the AS security. The user data are ciphered and transmitted on DTCH multiplexed with the *RRCConnectionResumeRequest* message on CCCH. If enabled in the cell, the UE may indicate AS Release Assistance Information.

2. The eNB initiates the S1-AP Context Resume procedure to resume the S1 connection and re-activate the S1-U bearers.

3. The MME requests the S-GW to re-activate the S1-U bearers for the UE.

4. The MME confirms the UE context resumption to the eNB.

5. The uplink data are delivered to the S-GW.

6. If downlink data are available, the S-GW sends the downlink data to the eNB.

7. If no further data are expected, the eNB can initiate the suspension of the S1 connection and the deactivation of the S1-U bearers.

8. The eNB sends the *RRCConnectionRelease* message to keep the UE in RRC\_IDLE. The message includes the *releaseCause* set to *rrc-Suspend*, the *resumeID,* the *NextHopChainingCount* and *drb-ContinueROHC* which are stored by the UE. If downlink data were received in step 6, they are sent ciphered on DTCH multiplexed with the *RRCConnectionRelease* message on DCCH. The procedure ends with the reception of the HARQ feedback (ARQ) acknowledging the successful DL transmission.

The MO-EDT procedure for User Plane CIoT 5GS Optimisation is illustrated in Figure 7.3b-2a.



Figure 7.3b-2a: MO-EDT for User Plane CIoT 5GS Optimisation

0. Upon connection resumption request for Mobile Originated data from the upper layers, the UE initiates the MO-EDT procedure and selects a random access preamble configured for EDT.

1. The UE sends an *RRCConnectionResumeRequest* to the ng-eNB, including its I-RNTI, the resume cause, and an authentication token. The UE resumes all SRBs and DRBs, derives new security keys using the *NextHopChainingCount* provided in the *RRCConnectionRelease* message of the previous connection and re-establishes the AS security. The user data are ciphered and transmitted on DTCH multiplexed with the *RRCConnectionResumeRequest* message on CCCH. The UE may indicate AS Release Assistance Information.

2. The uplink data are delivered to the UPF.

3. The ng-eNB sends a NG-AP Context Resume Request message to the AMF to resume the connection. If the UE included AS Release Assistance information indicating No further UL/DL higher layer PDU in step 1, ng-eNB may request for immediate transition to RRC IDLE with Suspend.

4. If the AMF does not receive a request for immediate transition to RRC IDLE with Suspend in step 3 or the AMF is aware of downlink data or signalling pending, the AMF requests the SMF to resume the PDU session.

5. The AMF sends a NG-AP Context Resume Response to the ng-eNB. If the AMF receives a request for immediate transition to RRC IDLE with Suspend in step 3 and there is no downlink data or signalling pending, the AMF includes a Suspend indication, and keeps the UE in CM-IDLE with Suspend.

6. If the AMF includes Suspend indication in step 5, the ng-eNB proceeds to step 8. If the AMF does not include Suspend indication and the UE included AS Release Assistance information indicating Only a single Downlink Data transmission subsequent to the Uplink transmission in step 1, the ng-eNB may wait for the DL data to arrive, and proceeds to step 7.

7 The ng-eNB initiates the NG-AP UE Context Suspend procedure to inform the AMF that the RRC connection is being suspended. The AMF requests the SMF to suspend the PDU session and the SMF requests the UPF to release the tunnel information for the UE.

8. The eNB sends the *RRCConnectionRelease* message to keep the UE in RRC\_IDLE. The message includes the *releaseCause* set to *rrc-Suspend*, the *I-RNTI,* the *NextHopChainingCount* and *drb-ContinueROHC* which are stored by the UE. If downlink data were received in step 6, they are sent ciphered on DTCH multiplexed with the *RRCConnectionRelease* message on DCCH. The procedure ends with the reception of the HARQ feedback (ACK) acknowledging the successful DL transmission.

NOTE 1: If the MME/AMF or (ng-)eNB decides the UE to move in RRC\_CONNECTED mode, *RRCConnectionResume* message is sent in step 7 to fall back to the RRC Connection resume procedure. In that case, the *RRCConnectionResume* message is integrity protected and ciphered with the keys derived in step 1 and the UE ignores the *NextHopChainingCount* included in the *RRCConnectionResume* message. Downlink data can be transmitted on DTCH multiplexed with the *RRCConnectionResume* message. In addition, an *RRCConnectionSetup* can also be sent in step 7 to fall back to the RRC Connection establishment procedure.

NOTE 2: If neither *RRCConnectionRelease* nor, in case of fallback, *RRCConnectionResume* is received in response to *RRCConnectionResumeRequest* for MO-EDT,the UE considers the UL data transmission not successful.

For MO-EDT for User Plane CIoT EPS Optimisation and User Plane CIoT 5GS Optimisation, an RRC connection can also be resumed in an (ng-)eNB (the new (ng-)eNB) different from the one where the connection was suspended (the old (ng-)eNB). Inter (ng-)eNB connection resumption is handled using context fetching, whereby the new (ng-)eNB retrieves the UE context from the old (ng-)eNB over the X2 (Xn) interface. The new (ng-)eNB provides the Resume ID for EPS or I-RNTI for 5GS which is used by the old (ng-)eNB to identify the UE context. This is illustrated in Figure 7.3b-3 and Figure 7.3b-3a for the case of User Plane CIoT EPS Optimisation and for the case of User Plane CIoT 5GS Optimisation respectively.

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### 7.3c.3 MT-EDT for User Plane CIoT EPS Optimisation

The MT-EDT procedure for User Plane CIoT EPS Optimisation is illustrated in Figure 7.3c-2.



Figure 7.3c-2: MT-EDT for User Plane CIoT EPS Optimisation

1. Upon arrival of downlink data, the SGW may send the DL data size to the MME for MT-EDT consideration by the MME.

2. The MME includes the DL data size in the S1-AP PAGING message to assist eNodeB in triggering MT- EDT.

3. If the data can fit in one single downlink transmission according to the UE category included in the UE Radio Capability for Paging provided in the S1-AP Paging message, the eNB includes *mt-EDT* indication in the *Paging* message for the UE.

4. The UE initiates the MO-EDT procedure for the User Plane CIoT EPS Optimisation as described in clause 7.3b.3/ figure 7.3b-2 with the following differences:

- In step 0, the UE selects a random access preamble not configured for EDT;

- In step 1, the UE sends *RRCConnectionResumeRequest* message with the resume cause *mt-EDT* and without user data.

- In step 4, the MME may include the Pending Data Indication in the S1AP UE Context Resume Response message to notify the eNB of further data traffic in excess of that initially signalled in step 2. The eNB may use this indication to decide whether to release the UE.



Figure: 7.3b-3: MO-EDT for User Plane CIoT EPS Optimisations in different eNB



Figure: 7.3b-3a: MO-EDT for User Plane CIoT 5GS Optimisation in different ng-eNB

1. Same as step 1 in the intra (ng-)eNB connection resumption.

2. The new (ng-)eNB locates the old (ng-)eNB using the Resume ID (for EPS) or I-RNTI (for 5GS) and retrieves the UE context by means of the X2-AP (for EPS) or Xn-AP (for 5GS) Retrieve UE Context procedure.

3. The old (ng-)eNB responds with the UE context associated with the Resume ID (for EPS) or I-RNTI (for 5GS).

4. For EPS, the new eNB initiates the S1-AP Path Switch procedure to establish a S1 UE associated signalling connection to the serving MME and to request the MME to resume the UE context. For 5GS, the new ng-eNB initiates the NG-AP Path Switch procedure to establish a NG UE associated signalling connection to the serving AMF and to request the AMF to resume the UE context.

5. For EPS, the MME requests the S-GW to activate the S1-U bearers for the UE and updates the downlink path. For 5GS, the AMF requests requests the SMF to resume the PDU session and the SMF requests the UPF to create the tunnel information for the UE and update the downlink path.

6. MME/AMF Acks step 5.

7. For EPS, after the S1-AP Path Switch procedure the new eNB triggers release of the UE context at the old eNB by means of the X2-AP UE Context Release procedure. For 5GS, after the NG-AP Path Switch procedure the new ng-eNB triggers release of the UE context at the old ng-eNB by means of the Xn-AP UE Context Release procedure.

8. For EPS, same as step 5 in the intra eNB connection resumption. For 5GS, the uplink data are delivered to the UPF.

9. Same as step 6 in the intra (ng-)eNB connection resumption.

10. Same as step 7 in the intra (ng-)eNB connection resumption.

11. Same as step 8 in the intra (ng-)eNB connection resumption.

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### 7.3d.4 Transmission using PUR for User Plane CIoT EPS/5GS Optimisations

Transmission using PUR for User Plane CIoT EPS Optimisation, as defined in TS 24.301 [20], and for User Plane CIoT 5GS Optimisation, as defined in TS 24.501 [91], are characterised as below:

- The UE is in RRC\_IDLE and has a valid PUR resource;

- The UE has been provided with a *NextHopChainingCount* in the *RRCConnectionRelease* message with suspend indication;

- Uplink user data are transmitted on DTCH multiplexed with *RRCConnectionResumeRequest* message on CCCH;

- Downlink user data are optionally transmitted on DTCH multiplexed with *RRCConnectionRelease* message on DCCH;

- The user data in uplink and downlink are ciphered. The keys are derived using the *NextHopChainingCount* provided in the *RRCConnectionRelease* message of the previous RRC connection;

- The *RRCConnectionRelease* message is integrity protected and ciphered using the newly derived keys;

- There is no transition to RRC CONNECTED.

The procedure for transmission using PUR for the User Plane CIoT EPS optimisation and for the User Plane CIoT 5GS optimisation is illustrated in Figure 7.3d-3 and Figure 7.3d-4 respectively.



Figure 7.3d-3: Transmission using PUR for the User Plane CIoT EPS Optimisation



Figure 7.3d-4: Transmission using PUR for the User Plane CIoT 5GS Optimisation

0. The UE has validated the PUR resource according to the configured criteria.

1 Same as step 1 in MO-EDT for User Plane CIoT EPS/5GS optimisations in Figure 7.3b-2 and 7.3b-2a except that the UE transmits over the PUR resource instead of a resource allocated in the random access response.

 If the user data are too large to be fully included in the transmission using PUR, the UE can use PUR to transmit *RRCConnectionResumeRequest* and a segment of the user data. The procedure will fall back to the legacy RRC Connection Resume procedure; a new C-RNTI can be assigned.

 After step 1, the (ng-)eNB may request the UE to abort the transmission using PUR by sending a Layer 1 fallback indication. UE actions upon reception of Layer 1 fallback indication are left up to UE implementation.

2..7 Same as MO-EDT for User Plane CIoT EPS/5GS optimisations in Figure 7.3b-2 and 7.3b-2a.

8 Same as step 8 in MO-EDT for user Plane CIoT EPS/5GS optimisations in Figure 7.3b-2 and 7.3b-2a except that a Time Advance Command can also be included.

NOTE 1: If the MME/AMF or the (ng-)eNB decides to move the UE to RRC\_CONNECTED mode, *RRCConnectionResume* message is sent in step 8 to fall back to the RRC Connection resume procedure. In that case, the *RRCConnectionResume* message is integrity protected and ciphered with the keys derived in step 1 and the UE ignores the *NextHopChainingCount* included in the *RRCConnectionResume* message; a new C-RNTI can be assigned. Downlink data can be transmitted on DTCH multiplexed with the *RRCConnectionResume* message. In addition, an *RRCConnectionSetup* can also be sent in step 8 to fall back to the RRC Connection establishment procedure.

NOTE 2: If neither *RRCConnectionRelease* nor, in case of fallback, *RRCConnectionResume* is received in response to *RRCConnectionResumeRequest* using PUR, the UE considers the UL data transmission not successful.