3GPP TSG-RAN WG2 Meeting #112-e R2-200xxxx

Online, 2nd – 13th November 2020

**Agenda item: 4.2**

**Source: Huawei (email discussion rapporteur)**

**Title: E-mail discussion [Post111-e][922][NB-IoT/eMTC R15] UP EDT for DRB using RLC AM (Huawei)**

**Document for: Report**

# 1 Introduction

This document is the report of the following e-mail discussion:

* [Post111-e][922][NBIOT/eMTC R15] UP EDT for DRB using RLC AM (Huawei)

Scope: Continue the discussion

Intended outcome: Report in R2-2008239

Deadline: Long

# 2 Discussion

## 2.1 Background

The issue was raised by document [1] which was discussed online with the following comments:

[R2-2007327](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_111-e/Docs/R2-2007327.zip) Discussion of UP EDT for DRB using RLC AM Huawei, HiSilicon discussion Rel-15 NB\_IOTenh2-Core, LTE\_eMTC4-Core

* Ericsson wonders what HW has observed in IODT. HW explains that UL grant is given for the UE to provide the report. The other case is sending the poll bit witn no UL grant.
* Ericsson asks whether the default configuration for PUCCH/PUSCH would still be used for such transnmission. HW thinks that would only be for Msg3.
* QC thinks this may be addressed by stating that UE should not be polled in Msg4 when RRC connection is released.

Then an offline discussion [AT111-e][402][NB-IoT/eMTC R15] UP EDT for DRB using RLC AM (Huawei) took place [2] and it was agreed to continue the discussion taking into account the comments from the companies.

Note that the discussion points in this document are organised slightly differently from offline discussion [402].

For the different discussion points, companies are invited to provide their views but also to comment on what would be the impact of the different options on the UE behaviour and the specification.

## 2.2 Handling of UL user data

### 2.2.1 Poll bit setting in the RLC PDU(s) carrying the UL user data for UP-EDT.

In offline discussion [402] [2], there was the following revised proposal and corresponding comments:

Proposal 3: Follow the legacy RLC procedure for poll bit setting in the RLC PDU(s) carrying the UL user data for UP-EDT.

|  |  |  |
| --- | --- | --- |
| **Company** | **do you agree**  **(yes/no)** | **Comments** |
| Qualcomm | Yes with revised proposal. | Existing procedures for setting POLL bit in plink RLC PDU shall be followed. |
| Huawei, HiSilicon | Yes | Fine with the revision |
| Sequans | Yes | Revision is fine |
| ZTE | No | Even we think data reliability is important, we still think it’s not so necessary to set POLL bit for UL data for EDT or PUR. This may be a little different from the DL transmission.  For UL transmission, if Msg3/UL data is not received successfully, retransmission should be triggered instead of sending MSG4. UE can assume that reception of *RRCConnectionRelease* is an implicit RLC ACK of all the RLC PDUs included in the UL transmission. |
| Ericsson | Yes | This is according to the existing specifications and therefore there doesn't seem to be anything additional what needs to be done.  It is possible to use RLC AM with UP EDT and we don't see this should be changed. |

**Discussion Point 1:** Whether to follow the legacy RLC procedure for poll bit setting in the RLC PDU(s) carrying the UL user data for UP-EDT**.**

**Company views**

Please add your view again in the table below as well any additional comment you may have on what would be the consequence of one way or the other.

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Comments** |
| Huawei, HiSilicon | yes | We do not see any motivation to change the legacy behaviour. Also, the fallback case should be considered and should not be affected.  w.r.t to ZTE’s proposal of an implicit acknowledgment, it would have to applied also to the reception of RRCConnectionResume (fall back case) and would require to make PDCP and RLC aware of EDT and multiple changes to the specifications:   * RLC: to specify that the UE shall not request a poll in this case. * RRC: to notify PDCP that the EDT PDCP PDU(s) has been successfully delivered   PDCP: to consider that the EDT PDCP PDU(s) has been successfully delivered and possibly to remember which PDCP PDU(s) were transmitted as part as EDT (for the abnormal case of new UL data arrival after initiation of EDT) |
| Qualcomm | yes | Follow existing procedure for POLL bit setting in uplink RLC PDU. |
| vivo | yes | We also agree to follow the legacy procedure (i.e. a poll is set in the RLC PDU with the UL UP data during the MO-EDT procedure) since no specific technical issue is observed. |
| Ericsson | Yes | We do not see any motivation to change the legacy behaviour either. Agree with Huawei above regarding the impact on PDCP, RLC and RRC layers if ZTE’s proposal on implicit RLC ACK were to be agreed. |
| Sequans | Yes | Agree with HW |
| Nokia | Yes | As there is Msg4 in response fo Msg3 carrying UL data, the RLC status PDU can also be sent in the same. No major benefit of disabling the poll bit or defining implicit ACK. |
| ZTE | Yes | Considering some potential specification changes mentioned in above comments, we are fine to follow the legacy procedure for POLL bit setting in uplink RLC PDU. |

### 2.2.2 RLC STATUS PDU in MSG4 (carrying RRCConnectionRelease) for each POLL in RLC PDU included in the uplink transmission.

In offline discussion [402] [2], there was the following revised proposal and corresponding comments:

Proposal 5: A RLC STATUS PDU is included in MSG4 (carrying RRCConnectionRelease) for each POLL in RLC PDU included in the uplink transmission**.**

|  |  |  |
| --- | --- | --- |
| **Company** | **do you agree**  **(yes/no)** | **Comments** |
| Qualcomm | Yes with the modified proposal. | eNB only required to send RLC STATU PDU if UE polled the eNB, otherwise it is not necessary for eNB to send RLC STATUS PDU. |
| Huawei, HiSilicon | Yes | We are fine with the rewording. we assume this covers the case where two RLC PDUs for the same DRBs are included in the UL transmission |
| Sequans | Yes | Revision is fine |
| ZTE | No |  |
| Ericsson | No | It is very likely that a NW implementation would include the RLC STATUS in Msg4 if the intention is to release the UE back to Idle after EDT.  We don't see a need to change the legacy conditions or operation regarding this. |
| Nokia | No | Proposal is fine. But it does not require any change in specification. It is upto network to handle this situation. |

**Discussion Point 2:** Whether a RLC STATUS PDU is included in MSG4 (carrying RRCConnectionRelease) for each POLL in RLC PDU included in the uplink transmission**.**

**Company views**

Please add your view again in the table below as well any additional comment you may have on what would be the consequence of one way or the other.

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Comments** |
| Huawei, HiSilicon | yes | Correction to our previous comment: there will be at most one RLC PDU per DRB and that there should be no data left after the transmission, thus each RLC PDU included in the uplink transmission shall have the POLL if answer to discussion point 1 is yes.  Unless we introduce a new behaviour, if the RLC STATUS is not included in MSG4, then PDCP (and thus upper layers) will consider the corresponding PDCP PDU(s) was(were) not successfully delivered. We do not see a need to change the specification, this is legacy behaviour and the eNB should be aware of the consequence of not including the RLC STATUS in MSG4. Still, it would be nice to capture this understanding in the chair minutes.  The other alternative would be to specify an implicit acknowledgment, which would require changes to RRC and PDCP specifications. We do not see any motivation for such a change. |
| Qualcomm | yes | It is up to eNB whether RLC STATUS PDU is included in MSG4 and we don’t see the need to change this for UP EDT.  If RLC in the UE was expecting STATUS PDU but eNB does not include this in MSG4 then legacy procedure should be sufficient i.e. upper layers notified of failure to deliver SDU and upper layers may re-try. |
| vivo | Leave to NW implementation | We think we should not make any restrictions on the network. For example, in case of network congestion, the NW may decide to directly send the RRCConnectionRelease with the extended wait time, instead of sending RLC STATUS PDU.  Usually, if the UL UP data has been successfully decoded and processed, we think the RLC STATUS PDU should be included in the Msg4 carrying *RRCConnectionRelease* for the POLL in UL RLC PDU. |
| Ericsson | No | Even though it is very likely that RLC STATUS is included in Msg4 (carrying RRC connection release message) after EDT, we do not see any motivation to change the legacy behaviour and prefer to leave this up to network implementation as specified. No need to change the specifications.  UP-EDT case is different compared to the legacy, where UE may re-try if positive ACK through STATUS PDU is not received. A received *RRCConnectionRelease* during UP-EDT should imply that the the data has been received successfully thus there should be no reason for the UE to re-try. |
| Sequans | Yes | Using MSG4 as an implicit ACK would require large spec change, as described by HW, which we do not see the benefit of, as the same result is achieved by including the RLC STATUS PDU. A note in the chair minutes would be good. |
| Nokia | Yes | We prefer to leave this to network implementation. If network does not include status PDU if UE expects the same, UE may inform the failure to upper layer. And also it is expected behaviour of receiving end when poll bit is set. |
| ZTE | Leave to eNB implementation | Similar view as some above comments. It’s no need to make any restrictions on the network and legacy behaviour is enough. |

## 2.2 Handling of DL user data

In offline discussion [402] [2], there was the following proposal and corresponding comments:

**Proposal 1: The poll bit shall not be set in the RLC PDU carrying RRCConnectionRelease message for UP-EDT.**

|  |  |  |
| --- | --- | --- |
| **Company** | **do you agree**  **(yes/no)** | **Comments** |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Sequans | Yes |  |
| ZTE | Yes |  |
| Ericsson | No | We do not want to add restrictions on existing functionality. In our understanding the NW implementation would not typically poll in this case. However, if eNB would include the poll bit, a proper implementation should ensure the polling would work e.g. by including an UL grant.  The following is noted in TS 36.331:  NOTE 2: Until successful connection resumption, the default physical layer configuration and the default MAC Main configuration are applied for the transmission of SRB0 and SRB1, and SRB1 is used only for the transfer of *RRCConnectionResume* message, and *RRCConnectionRelease* message if security has been re-activated.  According to how UP-EDT is specified, "successful connection resumption" has not happened and therefore we think the default configuration (e.g. for PUSCH) applies at this stage, i.e. before *RRCConnectionRelease* is fully processed. |
| Nokia | No | In this case, network implementation can take care of not setting the poll bit |

Note that the corresponding proposal for the DL RLC PDUs in offline discussion [402] [2] was updated in the middle of the discussion and was wrongly formulated, thus the corresponding comments are not included here.

### 2.3.1 UL grant and UL transmission of RLC STATUS PDU after MSG4 carrying RRCConnectionRelease message for EDT

Based on the comments during offline [302], it seems that the first point to discuss is whether UL grant can be scheduled and the UE transmits RLC STATUS after successful transmission of MSG4 carrying RRCConnectionRelease message for EDT.

**Discussion Point 3:** Whether an UL grant can be scheduled and the UE transmits RLC STATUS after successful transmission of MSG4 carrying RRCConnectionRelease message for EDT.

**Company views**

Please add your view in the table below as well any additional comment you may have on what would be the consequence of one way or the other.

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Comments** |
| Huawei, HiSilicon | No | MAC is under control of RRC, which configures it for different purpose, e.g. PCH reception, BCH reception, random access procedure, or DL-SCH or UL-SCH data transfer. At the exception of the random procedure initiated by MAC for which the handling is fully described in the MAC specification, there is no indication that MAC switches procedure on its own. When the random access procedure is complete, MAC is not required to perform any other actions and is waiting for RRC to reconfigure it for another procedure.  Also, for NB-IoT, it is clearly specified that the UL/DL carrier associated to the NPRACH resource is only used for MSG1/MSG2/MSG3 and MSG4, the same applies to the configuration of CSS type 2.  To allow such behaviour would require changes at least to the RRC specification, possibly to MAC, and could introduce unwanted side effects (e.g. for the abnormal case where new UL data have arrived).  We do not see the motivation for allowing further transmission in the CSS after the random access procedure. We do not think this prevents using EDT with RLC AM, we only need to specify that the HARQ ACK for MSG4 is an implicit RLC ACK of all the transmitted RLC PDUs. As this only affects the eNB, this can be clarified in stage 2. |
| Qualcomm | No | We don’t think it makes sense for eNB to poll the UE in MSG4, HARQ ACK should be sufficient that MSG4 has been received. If MSG4 was not received, then UP-EDT would fail, and UE would retry.  But specification needs to clear on the expected UE behaviour if network does poll the UE i.e. whether UE should respond to the poll.  Technically it should be ok for UE to respond to the POLL using the same uplink carrier as used for MSG3 and this should not cause contention with other UEs because the grant in this case should be to this single UE. Note: In this case temporary C-RNTI becomes C-RNTI. Also reminder that following *early contention resolution* (mandatory for NB-IoT from Release 15) the random access procedure is complete (see 36.321 section 5.1.5) and UE continues to use the same downlink (for NPDCCH and NPDSCH) and uplink (i.e. for HARQ-ACK transmission). Therefore, with EDT allowing UE to transmit RLC STATUS message should be ok (RRC specification allows for UE to transmit RLC STATUS before returning to idle – see 36.331 section 5.3.8.3). |
| vivo | No | Upon receiving the Msg4 with carrying RRCConnectionRelease, the UE completes the UP-EDT procedure. We are wondering is it possible for the UE in this case to monitor an NPDCCH containing UL grant for RLC STATUS PDU transmission based on the current spec?  We assume that the intended meaning of this question is that “whether a UL grant can be scheduled and the UE transmits RLC STATUS after successful contention resolution but before receiving RRCConnectionRelease message for UP-EDT?”, regarding this hypothetical question, although we agree with Ericsson that the subsequent UL transmission for RLC STAUS PDU can be realized based on the current spec, we prefer the UL HARQ-ACK is used as RLC-ACK in UP-EDT procedure, which is beneficial for UE power saving. |
| Ericsson | Yes | We think that the network would not typically poll in this case, however if the poll bit is included, based on existing functionality, the UE should transmit the RLC STATUS. An UL grant is provided preferably along with the RRC connection release message in such case. |
| Sequans | No | Current spec is not quite clear enough on how this polling would work, as can be seen from the comments above. It would be simpler, cleaner and beneficial to UE power to specify MSG4 as an implicit RLC ACK, which can be done is Stage 2 spec, as suggested by HW. |
| Nokia | No | We don’t think, Network will poll the UE for status report in Msg4. Setting this bit in RLC level and considering HARQ level ack which anyhow happens without this poll bit does not seem to be right work-around. In our view, UE can ignore this poll bit in Msg4 and enter IDLE state after sending HARQ-ACK. |
| ZTE | No | Similar view as Qualcomm. |

### 2.3.2 Poll bit setting in the RLC PDU(s) carrying the DL user data for UP-EDT

**Discussion Point 4:** Whether to follow the legacy RLC procedure for poll bit setting in the RLC PDU(s) carrying the DL user data for UP-EDT**.**

**Company views**

Please add your view in the table below as well any additional comment you may have on what would be the consequence of one way or the other and whether this depends on the answer to discussion point 3.

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Comments** |
| Huawei, HiSilicon | yes | If the answer to discussion point 3 is yes, this is necessary to trigger the UE to send a RLC\_STATUS.  If the answer to discussion point 3 is no, we do not think setting the poll bit harms (the RLC STATUS PDU will just not be sent) and this avoids to introduce a change in the RLC specification. |
| Qualcomm | - | Setting of poll bit in MSG4 is up to eNB implementation.  We think legacy specification applies but, as per our response to Q3, we don’t think eNB should poll UE in MSG4. |
| vivo |  | We are wondering whether setting the poll in the DL RLC PDU(s) carrying the DL user data for UP-EDT can be regarded as the legacy RLC procedure since the behavior specified in the E-TURA RLC specification is for UE. Anyway, we think the eNB should not poll UE during the UP-EDT procedure. |
| Ericsson | Yes |  |
| Sequans | Yes, if the answer to DP3 is yes | Otherwise, if the poll bit is not set / ignored this question is moot |
| ZTE | - | Similar view as Qualcomm. |

### 2.3.4 Poll bit setting in the RLC PDU carrying RRCConnectionRelease for UP-EDT

**Discussion Point 5:** Whether the poll bit shall be set in the RLC PDU carrying RRCConnectionRelease for UP-EDT**.**

**Company views**

Please add your view in the table below as well any additional comment you may have on what would be the consequence of one way or the other and whether this depends on the answer to discussion point 3.

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Comments** |
| Huawei, HiSilicon | no | If the answer to discussion point 3 is yes, it does not really matter and this can be left to eNB implementation as per today.  If the answer to discussion point 3 is no, setting of the poll bit will delay the release of the radio resources (10 s in NB-IoT) for no benefit as no RLC\_STATUS will be sent. We do not see a need to change the specification, this is legacy behaviour and the eNB should be aware of the consequence of setting the poll bit. Still, it would be nice to capture this understanding in the chair minutes. |
| Qualcomm | No | As per our response to Q4. |
| vivo | No | Upon receiving RRCConnectionRelease, the UE completes the UP-EDT procedure. After that, it seems there will be no available PUSCH resource for the UE to transmit the RLC STATUS PDU. So, the NW should not set the poll in the DL RLC PDU carrying RRCConnectionRelease for UP-EDT. |
| Ericsson | - | This is up to eNB implementation as specified today. If the poll bit is to be set, an UL grant is provided preferably along with the RRC connection release message so that the UE would not need to continue monitoring before releasing the radio resources. Regarding the configuration for transmission in the UL; considering the note below from 36.331:  NOTE 2: Until successful connection resumption, the default physical layer configuration and the default MAC Main configuration are applied for the transmission of SRB0 and SRB1, and SRB1 is used only for the transfer of *RRCConnectionResume* message, and *RRCConnectionRelease* message if security has been re-activated.  We think that the default configuration is applied for transmission in the UL, e.g., PUSCH since "successful connection resumption" is not considered to have happened for UP-EDT as specified. |
| Sequans | No | Agree with HW |
| Nokia | No | As per earlier answer to Discussion point 3. |
| ZTE | No | Similar view as Qualcomm’s comments for DP3. |

## 2.3 MT-EDT

**Discussion Point 6:** Please indicate whether you see any difference, when applicable, for MT-EDT compared to MO-EDT.

**Company views**

Please add your view in the table below as well any additional comment you may have on what would be the consequence of one way or the other.

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Comments** |
| Huawei, HiSilicon | no | We see no difference w.r.t to the DL data handling |
| Qualcomm | No | There is some difference between MO-EDT and MT-EDT. That is, if eNB considers failure to deliver MSG4 then it is up to NW retransmit MSG4 or to page the UE again for MT-EDT.  But we don’t propose to have different UE handling for poll in MSG4 by eNB for MO-EDT and MT-EDT. |
| vivo | No | We cannot find out any difference. |
| Ericsson | No |  |
| Sequans | No |  |
| Nokia | No |  |
| ZTE | No |  |

## 2.4 PUR

**Discussion Point 7:** Please indicate whether you see any difference, when applicable, for PUR compared to MO-EDT

**Company views**

Please add your view in the table below as well any additional comment you may have on what would be the consequence of one way or the other.

|  |  |  |
| --- | --- | --- |
| **Company** | **yes/no** | **Comments** |
| Huawei, HiSilicon | No | A major difference for PUR is that the UL and DL data transmission does not take place during the random access procedure but during UL-SCH data and DL-SCH data transfer procedures in the USS.  We see no difference w.r.t to the UL data handling.  For the DL data handling, it should be possible to schedule a UL grant for the UE to transmit the RLC ACK. However, PUR is optimised for power consumption and RAN2 has agreed for the CP solution that a layer 1 acknowledgment was sufficient to complete the procedure. Thus we do not see the need to have a different behaviour for UP-PUR compared to MO-EDT. |
| Qualcomm | No | Apart from CSS vs USS difference as pointed out by HW, UP PUR is same as UP MO-EDT hence don’t see the need for a different handling. |
| vivo | No | We share the same view with Huawei and Qualcomm. |
| Ericsson | No | The difference with respect to the cases for UL and DL in UP-EDT is that transmission takes place using the UL-SCH and DL-SCH data transfer procedures and thus the corresponding configurations can be used. |
| Sequans | No | Agree with above |
| Nokia | No |  |
| ZTE | No |  |

## 2.5 Other

Please add in the table any aspects that have missed in the discussion above or other general comment

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| --- | --- |
| **Company** | **Comments** |
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# 3 Summary

# 4 List of referenced documents

1. [R2-2007327](http://ftp.3gpp.org/tsg_ran/WG2_RL2/TSGR2_111-e/Docs/R2-2007327.zip) Discussion of UP EDT for DRB using RLC AM Huawei, HiSilicon, RAN2#111-e, Online, August 2020

1. [R2-2008232](http://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_111-e/Docs/R2-2008232.zip) Report of [AT111-e][402][NB-IoT/eMTC R15] UP EDT for DRB using RLC AM Huawei(rapporteur), RAN2#111-e, Online, August 2020