3GPP TSG-RAN WG2 Meeting #115 Electronic R2-21xxxxx

Elbonia, 16 – 27 August 2021

**Agenda item: 6.1.3.2**

**Source: Nokia, Nokia Shanghai Bell**

**Title: Report of [AT115-e][022][NR16] RLC & PDCP (Nokia)**

**Document for: Discussion and Decision**

# 1 Introduction

This is the summary of the following email discussion in RAN2#115-e meeting.

* [AT115-e][022][NR16] RLC & PDCP (Nokia)

 Scope: Determine agreeable parts and agree CRs, Treat R2-2108248, R2-2108249, R2-2108247, R2-2107662, R2-2107665

 Intended outcome: Report, Agreed CRs.

 Deadline: Schedule 1

# 2 Contact information

|  |  |
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# 3 Discussion

## 3.1 RLC

[R2-2108249](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108249.zip) Retransmission conditions upon expiry of t-PollRetransmit Nokia, Nokia Shanghai Bell CR Rel-16 38.322 16.2.0 0044 - F TEI16

**Reason for change:**

Currently, upon expiry of t-PollRetransmit, the transmitting side of an AM RLC entity shall:

- if both the transmission buffer and the retransmission buffer are empty (excluding transmitted RLC SDU or RLC SDU segment awaiting acknowledgements); or

- if no new RLC SDU or RLC SDU segment can be transmitted (e.g. due to window stalling):

 - consider the RLC SDU with the highest SN among the RLC SDUs submitted to lower layer for retransmission; or

 - consider any RLC SDU which has not been positively acknowledged for retransmission.

The intention is that when there is no AMD PDU queued for transmission that can naturally carry the re-sent poll, one is artificially created by considering a non-ACKed SDU for retransmission.

The current text implements this intention incorrectly: because the second condition (no new RLC SDU or RLC SDU segment can be transmitted) is now sufficient on its own, an SDU will artifically be considered for retransmission based on the second condition even if the retransmission buffer is non-empty.

**Solution:**

In the actions upon expiry of t-PollRetransmit, re-word the conditions for considering for retransmission a non-ACKed SDU to “if the retransmission buffer is empty (excluding transmitted RLC SDU or RLC SDU segment awaiting acknowledgements) and no new RLC SDU or RLC SDU segment can be transmitted (e.g. due to empty transmission buffer or window stalling)”.

**Q1: Comments on the issues and the solution of CR in** **R2-2108249?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Agree issue/Disagree issue | Agree solution/Disagree solution/Agree with modification | Detailed Comments |
| Samsung | Disagree | Disagree(Any solution is not needed.) | Our understanding is that the current specification is correct. Each condition covers different cases. We cannot combine two conditions but should keep two conditions, separately. The first condition specifies the case that there is indeed no new data in the transmission buffer and retransmission buffer while the second condition specifies the case that there is new data in the transmission buffer or retransmission buffer but new transmission is not allowed due to window stalling. That’s why we have two separate conditions in the current specifications.If these two conditions are combined with “and” condition as this CR proposed, then we cannot cover the latter case.  |
| LG | Disagree | Disagree | The first condition is for empty buffer case and the second condition is for window stalling case. The proposed change is merging two conditions, which seems to be unnecessary. Current text is clear enough. |
| Huawei, HiSilicon | Disagree | Disagree | Agree with above comments. We understand the current spec is from LTE, and don’t see a problem with it. |
| MediaTek | Disagree | Disagree |  |
| Ericsson | Disagree | Disagree |  |
| ZTE | Disagree | Disagree |  |
| OPPO | Disagree | Disagree | We also think the conditions are actually cover different cases, i.e., one is for the case when buffer is empty and the other is for the case when buffer is NOT empty but no new SDU/SDU segment can be transmitted due to window stalling. If combining these two conditions together, there will be errors when either of the condition is met. |
| CATT | Disagree | Disagree |  |
| Intel | Disagree | Disagree | Agree with Samsung and LG. In addition, the “or” condition as in current NR RLC spec is from LTE Rel-8, and there seems no issues observed. |
| Apple | Disagree | Disagree | As others have already mentioned the proposed change is a re-wording for both the existing cases which are already covered. We do not see any need for it.  |
| Nokia | Agree | Agree | Proponent |
| QCOM | Disagree | Disagree | We agree with Samsung, we think the second condition (no new data can be transmitted) is understood to be as a result of reasons other than transmission buffer being empty (since that is covered in the first condition and also since it specifically mentions window stalling). So second condition is not true if transmission buffer is empty but retransmission buffer is not empty. |

[R2-2108247](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108247.zip) Retransmission conditions upon expiry of t-PollRetransmit Nokia, Nokia Shanghai Bell CR Rel-16 36.322 16.0.0 0147 - F TEI16

The first issue in this CR is the same issue as above R2-2108249 but for LTE:

**Reason for change:**

1. Currently, upon expiry of t-PollRetransmit, the transmitting side of an AM RLC entity shall:

- if both the transmission buffer and the retransmission buffer are empty (excluding transmitted RLC data PDU awaiting for acknowledgements); or

- if no new RLC data PDU can be transmitted (e.g. due to window stalling):

 - consider the AMD PDU with SN = VT(S) – 1 for retransmission; or

 - consider any AMD PDU which has not been positively acknowledged for retransmission;

The intention is that when there is no RLC Data PDU queued for transmission that can naturally carry the re-sent poll, one is artificially created by considering a non-ACKed AMD PDU for retransmission.

The current text implements this intention incorrectly: because the second condition (no new RLC data PDU can be transmitted) is now sufficient on its own, an AMD PDU will artifically be considered for retransmission based on the second condition even if the retransmission buffer is non-empty.

2. “await for acknowledgements” is not correct language. “For” is not used with “await”. In 38.322 this is already corrected.

3. Rudundant space in a Note: “E mpty”.

**Solution:**

1. In the actions upon expiry of t-PollRetransmit, re-word the conditions for considering for retransmission a non-ACKed AMD PDU to “if the retransmission buffer is empty (excluding transmitted RLC data PDU awaiting acknowledgements) and no new RLC data PDU can be transmitted (e.g. due to empty transmission buffer or window stalling)”.
2. Occurrences of “awaiting for acknowledgements” changed to “awaiting acknowledgements”.
3. “E mpty” corrected to “Empty”.

**Q2: Comments on the issues and the solution of CR in R2-2108247?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Agree issue/Disagree issue | Agree solution/Disagree solution/Agree with modification | Detailed Comments |
| Samsung | Disagree | Disagree(Any solution is not needed.) | Our understanding is that the current specification is correct. Please see our response for Q1.However, the editorial change 2) and 3) are acceptable to us. 2) may not be needed, actually. |
| LG | Disagree | Disagree | Editorial corrections (2 and 3) may be included in the Rapporteur CR. |
| Huawei, HiSilicon | Disagree | Disagree | Agree with above comments. The editorial changes can be implemented when producing the RLC spec for a new release. |
| MediaTek | Disagree | Disagree | Editorial changes are (2 and 3) OK |
| Ericsson | Disagree | Disagree/OK w editorial changes |  |
| ZTE | Disagree | Disagree | Editorial changes are ok |
| OPPO | Disagree | Disagree | We are ok on the editorial changes, and they can be fixed in the rapporteur CR. |
| CATT | Disagree | Disagree |  |
| Intel | Disagree | Disagree | Same comment for issue 1 as in reply to Q1. Editorial changes (2 and 3) can be included in rapporteur CR. |
| Apple | Disagree | Disagree | Only editorial changes are ok.  |
| Nokia | Agree | Agree | Proponent |
| QCOM | Disagree | Disagree | Fine with the editorial changes only.  |

[R2-2108248](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108248.zip) Conditions for incrementing RETX\_COUNT Nokia, Nokia Shanghai Bell CR Rel-16 38.322 16.2.0 0043 - F TEI16

**Reason for change:**

The current specification contains:

When an RLC SDU or an RLC SDU segment is considered for retransmission, the transmitting side of the AM RLC entity shall:

- if the RLC SDU or RLC SDU segment is considered for retransmission for the first time:

- set the RETX\_COUNT associated with the RLC SDU to zero.

- else, if it (the RLC SDU or the RLC SDU segment that is considered for retransmission) is not pending for retransmission already and the RETX\_COUNT associated with the RLC SDU has not been incremented due to another negative acknowledgment in the same STATUS PDU:

- increment the RETX\_COUNT.

1. When, due to one given Status PDU received, (parts of) a given SDU is considered for retransmission for the first time and for the second time, by the current specification text RETX\_COUNT associated with the SDU is first set to 0 and the inremented to 1, which is not the intention. This is because the initial setting of RETX\_COUNT to zero does not count as “incrementing” it, since RETX\_COUNT is never negative.
2. RAN2#113bis-e agreed that RETX\_COUNT is updated also when an SDU is considered for retransmission due to expiry of t-PollRetransmit. The wording “in the same STATUS PDU” alone gives the wrong impression that Status PDU is the sole reason for updating RETX\_COUNT.

**Solution:**

1. “RETX\_COUNT … incremented” replaced with “value of RETX\_COUNT … modified”;
2. “in the same STATUS PDU” is made subject to the assumption that the RLC SDU or the RLC SDU segment is considered for retransmission due to a STATUS PDU received.

**Q3: Comments on the issues and the solution of CR in R2-2108248?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Agree issue/Disagree issue | Agree solution/Disagree solution/Agree with modification | Detailed Comments |
| Samsung | Disagree | Disagree(Any solution is not needed.) | Our understanding is that the current specification is correct. In the early stage of NR, we designed RETX\_COUNT value based on the principle that it is incremented at most once per status PDU. That’s why we have the text “the same STATUS PDU” in the second condition.This CR raised up two issues. The first issue is that RETX\_COUNT value may be incremented twice when STATUS PDU is received. But that is not true. If we look into the procedure, we have “else if” condition. So if the first condition is satisfied, then we skip the next condition. So RETX\_COUNT value will not be incremented twice. The second issue is that RETX\_COUNT value should be updated if an SDU is considered for retransmission due to the expiry of t-PollRetransmit timer. The reason for the expiry of timer is that the AM RLC entity has not received STATUS PDU so there is no STATUS PDU there. In this reason, if we look into the current specification again, the RETX\_COUNT value will be updated as we agreed.So, the current spec will work as intended. |
| LG | Disagree | Disagree | We don’t see any problem with the current text, since from LTE Rel-8. |
| Huawei, HiSilicon | Disagree | Disagree | Agree with above comments. We think the RETX\_COUNT will not be incremented twice as the UE will check the condition of “if the RLC SDU segment is considered for retransmission for the first time”. Given the second half of RLC NACK indicating another missing RLC segment, the condition will be met and the RETX\_COUNT will be still set to zero considering it is associated with the RLC SDU, not a RLC SDU segment. |
| MediaTek | Disagree | Disagree |  |
| Ericsson | Disagree | Disagree |  |
| ZTE | Disagree | Disagree |  |
| OPPO | Disagree | Disagree | We don’t think the change is needed.When the SDU/SDU segment is first regarded as retransmission by receiving a status PDU, it’s set to ZERO and will not be incremented by 1 due to the “else if” used. |
| CATT | Disagree | Disagree | Current specification is clear. |
| Intel | Disagree | Disagree | We think current specification is clear. |
| Apple | Disagree | Disagree | RETX\_COUNT will not be incremented twice for the same RLC SDU while processing the status PDU due to the else if condition as mentioned by Samsung. We do not see the reason for a change.  |
| Nokia | Agree | Agree | Proponent |
| QCOM | MAY BE | MAY BE | The current text clear, the CR is fine as well, we will go with the majority. |

## 3.2 PDCP

[R2-2107662](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107662.zip) CR for LTE PDCP operation after DAPS release Samsung CR Rel-16 36.323 16.3.0 0296 - F NR\_Mob\_enh-Core

**Reason for change:**

In LTE, the PDCP operation is explicitly clarified in both cases that split bearer/LWA bearer is configured and it is re-configured to normal DRB in Section 5.1.2.1.4.

However, for DAPS handover, the LTE PDCP operation is specified only for the case that PDCP entity is reconfigured to configure DAPS and thus it is not clear which PDCP operation would be performed in the case that PDCP entity is reconfigured to release DAPS.

**Solution:**

To clarify the LTE PDCP operation in the case that PDCP entity is reconfigured to release DAPS.

**Q4: Comments on the issues and the solution of CR in R2-2107662?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Agree issue/Disagree issue | Agree solution/Disagree solution/Agree with modification | Detailed Comments |
| Samsung (Proponent) | Agree | Agree |  |
| LG | Disagree | Disagree | If DAPS is released, the PDCP entity becomes associated with only one RLC entity. Then, why the reordering function should be used? |
| Samsung |  |  | Regarding LG’s comment, RAN2 already agreed this as follows:**RAN2#109bis**S2.6-5-5: For the change from DAPS PDCP to the normal PDCP upon the source release, the reordering function is still maintained. |
| Huawei, HiSilicon | See comments | See comments | Unfortunately we fail to understand the previous agreements due to the same concern from LG. We are also wondering why this agreement has not been captured in PDCP running CR of DAPS, if it is essential. |
| MediaTek | Disagree | Disagree | Agree with LG. |
| Samsung |  |  | Regarding the above comments, Just for my understanding, then what is the PDCP operation when DAPS is released? DAPS PDCP should fall back to the previous PDCP operation when DAPS is released? Then, we need another CR for this.The reason why we should keep t-reordering upon DAPS release is the same as that of split DRB and LWA bearer, i.e. to support in-order delivery to upper layer for the received PDCP PDUs from the source link and the target link even when DAPS is released. |
| Ericsson | Agree to intent | See comment | Assuming this change is needed, we think we should not specify it like in the proposed CR.Actually, if we look at the other (non-DAPS) bullets in the interesting section, they talk about **states** the PDCP entity is in, e.g. the PDCP entity is or is not configured for LWA. E.g.:- the PDCP entity is configured for a LWA bearer; orBut the DAPS bullets talk about an **event**. E.g.:- the PDCP entity is reconfigured to configure DAPS; orI think we rather should write the existing DAPS-bullet to align with the other bullets, and we can implement Samsung's change in a similar way as non-DAPS bullets, i.e. talk about **states** instead of **events**. Like this:For DRBs mapped on RLC AM and RLC UM, for LWA bearers and when PDCP duplication is used, the PDCP entity shall use the reordering function as specified in this clause when:-   the PDCP entity is associated with two RLC entities; or-   the PDCP entity is configured for a LWA bearer; or-   the PDCP entity is configured for a DAPS bearer; or-   the PDCP entity is associated with one AM RLC entity after it was, according to the most recent reconfiguration, associated with two AM RLC entities or configured for a LWA bearer without performing PDCP re-establishment; or-   the PDCP entity is not configured for a DAPS bearer after it was, according to the most recent reconfiguration, configured for a DAPS bearer; or-   the PDCP entity is configured with PDCP duplication; or-   the PDCP entity is associated with at least one RLC entity configured with *rlc-OutOfOrderDelivery*.We would be fine with Samsung's proposal if captured in this manner, i.e. as states rather than events. |
| ZTE | Agree to intent | Either correction or MTK and Samsung can be accepted |  |
| OPPO | See comments |  | We also fail to see the case when PDCP is reconfigured to release DAPS, in this case, the PDCP entity is associated with just one RLC, why reordering is needed? |
| CATT | Disagree | Disagree | This modification is used for reordering function. For DAPS release, there is no need. |
| Intel | Disagree | Disagree | RAN2#109bis-e meeting has the following agreements:S2.6-5-5: For the change from DAPS PDCP to the normal PDCP upon the source release, the reordering function is still maintained.Above agreements means, same as the change from split bearer to non-split bearer, the PDCP reordering is kept, but we do not need to do additional change for that.  |
| Samsung |  |  | Regarding Ericsson’s comments, we agree to the suggestion. Regarding Oppo and CATT’s comments, The reason why we should keep t-reordering upon DAPS release is the same as that of split DRB and LWA bearer, which was already agreed in RAN2#109bis, i.e. to support in-order delivery to upper layer for the received PDCP PDUs from the source link and the target link even when DAPS is released.Regarding Intel’s comments, LTE PDCP specification specifies that t-Reordering is used when the split DRB is reconfigured to non-split DRB. We are trying to clarify the same thing as Ericsson mentioned above.Without this CR, we wonder if which PDCP operation should be used upon DAPS release. For example, Before DAPS configuration, * UM DRB uses Section 5.1.2.1.3
* AM DRB uses Section 5.1.2.1.2

 Upon the reception of DAPS configuration* First, state variables are updated.
* UM DRB uses Section 5.1.2.1.4
* AM DRB uses Section 5.1.2.1.4

The following is not clear in 36.323 Upon DAPS release* UM DRB uses which section???
* AM DRB uses which section???
 |
| Apple | Agree with intent | OK with Samsung proposal to capture this.  |  |
| Nokia | Agree with intent | See comment | We are wondering if the “the PDCP entity is associated with one AM RLC entity after it was, according to the most recent reconfiguration, associated with two AM RLC entities” would cover the DAPS bearer release case as well?However, if change is intended, we could accept Ericsson’s proposal. |
| Samsung |  |  | Regarding Nokia’s comment, as we know, in LTE, split and LWA bearer can be associated only with AM RLC entity while DAPS bearer can be associated with either AM RLC entity or UM RLC entity. In this reason (the legacy sentence only covers AM bearer), we need a separate sentence. We are also fine with Ericsson’s suggestion. |

[R2-2107665](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107665.zip) CR for the ciphering of EHC header Samsung CR Rel-16 38.323 16.4.0 0080 - F NR\_IIOT-Core

**Reason for change:**

In RAN2#107bis, RAN2 made the following agreements:

* The EHC function is in PDCP
* The EHC header is located after the SDAP header, and it is ciphered

However, the current PDCP specification does not capture that the EHC header is ciphered.

In Rel-15 LTE UDC, the similar issue, i.e. the UDC header is ciphered, was specified as follows:

|  |
| --- |
| 5.6 Ciphering and Deciphering5.6.0 GeneralThe ciphering function includes both ciphering and deciphering and is performed in PDCP. For the control plane, the data unit that is ciphered is the data part of the PDCP PDU (see clause 6.3.3) and the MAC-I (see clause 6.3.4). For the user plane, the data unit that is ciphered is the data part of the PDCP PDU (see clause 6.3.3); ciphering is not applicable to PDCP Control PDUs.6.3.3 DataLength: VariableThe Data field may include either one of the following:- Uncompressed PDCP SDU (user plane data, or control plane data); or- Compressed PDCP SDU (user plane data only); or- UDC header and UDC Data Block if UDC is configured. |

Given that Rel-17 NR UDC would be considered, the similar way is preferred for the ciphering of EHC header.

**Solution:**

To add a text “EHC header and compressed PDCP SDU if EHC is configured” to Section 6.3.3 to clarify that EHC header is ciphered.

**Q5: Comments on the issues and the solution of CR in R2-2107665?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Agree issue/Disagree issue | Agree solution/Disagree solution/Agree with modification | Detailed Comments |
| Samsung (Proponent) | Agree | Agree |  |
| LG | Disagree | Disagree | Looking at the figures in 6.2.2, the PDCP data PDU is composed of three parts, i.e. PDCP PDU header, Data, and optional MAC-I. In other words, all components should belong to the “Data” part except PDCP PDU header and MAC-I. It is strange interpretation that EHC header does not belong to “Data” part. Note that ROHC header also belongs to “Data” part, even if it is not specified.We think LTE PDCP specification should be changed, i.e. remove UDC related bullet, to avoid further misinterpretation.And, it is clear from 5.8 that “Data” part is ciphered (except SDAP header and SDAP control PDU) |
| Samsung |  |  | Regarding LG’s comment, it is difficult to check whether EHC header is ciphered or not as you explained. What is worse, the reader may not be confident of what you referred to since the PDCP specification does not say about it clearly. That’s why we got some feedback from implementation team.Regarding UDC related bullet in 6.3.3 of 36.323, what could be the misinterpretation? We think there would be a misinterpretation if we don’t have it.  |
| Huawei, HiSilicon | See comments | See comments | We share some sympathy on this CR. Recall this issue was discussed for several times before, we are also okay to capture it into the Chairman notes.In addition, we don’t believe there is a need to change to LTE as on the contrary we think the LTE spec is much clearer.  |
| MediaTek | Agree | Agree |  |
| Samsung |  |  |  |
| Ericsson |  |  | No change is really needed although we agree this is not the first time a similar topic has been discussed. Open to capture something if there is consensus. |
| ZTE |  |  | We also find some places to implicit indicate the EHC is ciphered5.12.5 Header decompression using EHCIf EHC is configured by upper layers for PDCP entities associated with user plane data, the PDCP Data PDUs are decompressed by the EHC protocol after performing deciphering and integrity verification as explained in clause 5.8 and 5.9, respectively. The header decompression is not applicable to the SDAP header and the SDAP Control PDU if included in the PDCP Data PDU.Anyway, if majorities would like to capture something for improve the readable, we can follow majorities. |
| OPPO | Disagree | Disagree | It seems data part already coveres the EHC header, so nothing needs to be clarified. |
| CATT | Agree | Agree | And one CR is also needed for LTE |
| Intel | Agree | Agree | We tend to think adding “EHC header” makes specification clearer since the existing bullets only mention SDU. |
| Apple | Agree | See Comments | Agree with Huawei’s proposal to capture it as Chairman’s notes (provided this is majority view) due to the number of times this topic has already been discussed.  |
| Nokia | Neutral | Agree | OK to capture. |
| QCOM | Disagree | Disagree | No doubt the EHC header has to undergo cyphering, which is the case for the RoHC header as well. In addition, it’s clear that EHC header is part of the data part of the PDU. Therefore the CR is not needed.  |

# 4 Conclusion

TBD