3GPP TSG-RAN WG2 Meeting #113bis Electronic R2-210xxxx

Elbonia, 12 – 20 April 2021

**Agenda item: 6.1.3**

**Source: Nokia, Nokia Shanghai Bell**

**Title: Report of [AT113bis-e][018][NR16] RLC PDCP BAP (Nokia)**

**Document for: Discussion and Decision**

# 1 Introduction

This is the summary of the following email discussion in RAN2#113bis-e Meeting.

* [AT113bis-e][018][NR16] RLC PDCP BAP (Nokia)

 Scope: Treat R2-2102943, R2-2102630, R2-2102846, R2-2103590, R2-2104203, R2-2104165

 Phase 1, determine agreeable parts, Phase 2, for agreeable parts Work on CRs.

 Intended outcome: Report and Agreed-in-principle CRs

 Deadline: Schedule A

# 2 Contact information

|  |  |
| --- | --- |
| Company | Contact: Name (E-mail) |
| LG | GyeongCheol LEE (gyeongcheol.lee@lge.com) |
| Huawei, HiSilicon | Zhenzhen Cao (caozhenzhen@huawei.com) |
| Ericsson | Henrik.enbuske@ericsson.com |
| MediaTek | Ming-Yuan Cheng (ming-yuan.cheng@mediatek.com) |
| Xiaomi | Yumin Wu (wuyumin@xiaomi.com) |
| CATT | Pierre Bertand (pierrebertrand@catt.cn) |
| Samsung | Donggun Kim (s\_dg.kim@samsung.com) |
| Nokia, Nokia Shanghai Bell | Samuli Turtinen (samuli.turtinen@nokia.com) |
| Intel | Ziyi Li (ziyi.li@intel.com) |
| vivo | Boubacar(kimba@vivo.com) |

# 3 Discussion

## 3.1 RLC

[R2-2102943](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113bis-e%5CDocs%5CR2-2102943.zip) RETX\_COUNT upon expiry of t-PollRetransmit Nokia, Nokia Shanghai Bell CR Rel-16 38.322 16.2.0 0040 - F NR\_newRAT-Core, TEI16

**Reason for change:**

In RLC AM, when RETX\_COUNT = *maxRetxThreshold*, RLC indicates this to RRC which considers failure of the link to cells to which the RLC is mapped. By the current specification, RETX\_COUNT is incremented also when the UE considers for retransmission “any RLC SDU which has not been positively acknowledged”, after *t-PollRetransmit* has expired.

This allows a lot of variance in UE behaviour as to how soon a given packet will exceed the maximum number of retransmissions, and consequently the UE RRC will take the appropriate action: e.g. while one UE implementation may choose the same packet for retransmission every time the poll-retransmit timer expires, another implementation may select different packets in a round-robin fashion.

The reason for the network not responding to polls from UE can be a mere network scheduling decision e.g. due to congestion, instead of a radio failure.

**Solution:**

The intention is to not increment RETX\_COUNT upon expiry of *t-PollRetransmit*.

**Q1: Comments on the issue and the solution of CR in R2-2102943?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Agree issue/Disagree issue | Agree solution/Disagree solution/Agree with modification | Detailed Comments |
| LG | Disagree | Disagree | We don’t think that this is a problem because normal implementation would not choose the same packet for retransmission every time the poll-retransmission timer expires. In addition, even though LTE also has almost same behavior, no problem has been identified in RAN2 so far. |
| Huawei, HiSilicon | Disagree | Disagree | This is an optimization, but not a correction. It is not a time to agree new enhancements for Rel-16. |
| Ericsson | Neutral | Disagree | Although this might be the case in some implementations, it would only be a rare issue in very high load situations.  |
| MediaTek | Disagree | Disagree |  |
| Xiaomi | Disagree | Disagree | We think a smart UE implementation would select a proper packet for retransmission. |
| CATT | Disagree | Disagree | We think it is an optimization for bad implementation. |
| Samsung | Disagree | Disagree | We think that retransmission COUNT value should be incremented if retransmission is considered by the expiry of t-PollRetransmit timer. There would be a case that UE should reach maximum retransmissn number if the timer continues to expire. This case will not be covered if we have this CR.  |
| Nokia, Nokia Shanghai Bell | Agree | Agree | Proponent.To comment about this to be optimization, there is this part specified in RLC:-    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.It seems this part of the specification already assumes the RLC SDU (segment) is only considered for re-transmission by NACK in STATUS PDU.Furthermore we had not seen the problem before because DC wasn’t deployed till now. Indeed EN-DC increases the possibility of not being scheduled for a while (since another CG can be alive) and thus increases the possibility of this problem to occur.  |
| Intel  | Disagree  | Disagree  | It seems that the proposal is an optimization. The related behavior is from LTE Rel-8, and no issues are identified.  |
| vivo | Disagree  | Disagree  |  |
|  |  |  |  |

## 3.2 PDCP

### 3.2.1 EHC

[R2-2102630](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113bis-e%5CDocs%5CR2-2102630.zip) LS on synchronization of Ethernet Compression (R3-211128; contact: Nokia) RAN3 LS in Rel-16 NR\_IIOT-Core To:RAN2 Cc:-

[R2-2102846](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113bis-e%5CDocs%5CR2-2102846.zip) Potential issues on synchronization of EHC Huawei, HiSilicon discussion NR\_IIOT-Core

[R2-2103590](file:///D%3A%5C%5CDocuments%5C%5C3GPP%5C%5Ctsg_ran%5C%5CWG2%5C%5CTSGR2_113bis-e%5C%5CDocs%5C%5CR2-2103590.zip%22%20%5Co%20%22D%3ADocuments3GPPtsg_ranWG2TSGR2_113bis-eDocsR2-2103590.zip) Response to RAN3 LS on state synchronization of EHC ZTE Corporation, Sanechips discussion Rel-16 NR\_IIOT-Core

The LS from RAN3 indicates:

|  |
| --- |
| **1. Overall Description:**RAN3 has discussed the configuration of Ethernet Compression in the case of disaggregated gNB architecture.In this case it is possible that CU UP decides to not run the compression proposed by CU CP (e.g. for processing load reason) while CU CP configures the UE to operate Ethernet Compression for the DRB.In this case RAN3 is not sure if the compression algorithm designed by RAN2 is able to automatically adapt to this initial desynchronized state between the UE and the CU UP. If the answer from RAN2 is negative for both Uplink and Downlink, RAN3 may need to add signalling to make CU CP aware of the CU UP decision to not run the compression before configuring the UE.**2. Actions:****To RAN2 group:****ACTION:** RAN3 would like to ask RAN2 to indicate if the compression algorithm designed by RAN2 is able to automatically adapt to an initial desynchronized state between the UE and the CU UP. |

**Discussion:**

[R2-2102846](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113bis-e%5CDocs%5CR2-2102846.zip) indicates it is not clear from the RAN3 LS if the CU UP would run the PDCP SDUs through EHC module. Naturally, in such case the desynchronization cannot be handled as the UE assumes EHC header in the PDCP PDUs it receives while it also encodes EHC in the UL PDCP SDUs it transmits. However, it seems RAN3 should have taken into account at least that the UE will generate EHC header in this case.

**Q2: Do companies agree that the EHC header should be always included in case UE is configured with EHC?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree/Agree with modification | Detailed Comments |
| LG | Agree | It is clear from PDCP specification that EHC header is always present when the UE is configured with EHC. |
| Huawei, HiSilicon | Agree |  |
| Ericsson | Agree | Like for other header fields used in PDCP (SN size etc), that are configured and synchronized between UE at DRB configuration without additional signaling. |
| MediaTek | Agree |  |
| Xiaomi | Agree |  |
| CATT | Agree with modification | Yes for UL since UE received EHC configuration from CU CP. However, PDCP specification doesn’t specify gNB behavior. The behavior of CU UP (i.e., consider EHC header even if it doesn’t perform EHC at all) need to be specified explicitly. |
| Samsung | Agree |  |
| Nokia, Nokia Shanghai Bell | Agree | Both in UL and DL. |
| Intel | Agree |  |
| vivo | Agree |  |

In case the EHC header is included in the DL/UL PDCP PDUs, both the [R2-2102846](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113bis-e%5CDocs%5CR2-2102846.zip) and [R2-2103590](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113bis-e%5CDocs%5CR2-2103590.zip) indicate that the desynchronization can be handled by the current means.

**Q3: Do companies agree that the desynchronization issue can be handled as long as the EHC headers are included in UL/DL PDCP SDUs in the scenario indicated by RAN3?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree/Agree with modification | Detailed Comments |
| LG | Agree | If CU UP decides to not run the compression proposed by CU CP, it can just send FH packet for DL, and avoid sending EHC feedback for UL. |
| Huawei, HiSilicon | Agree/Disagree | We think the wording in the LS is not clear and there can be different understandings. If “*CU UP decides to not run the compression proposed by CU CP*” means that at CU UP side the to-be-transmitted or received packets will anyway be processed in the EHC module but the packets will not be compressed, then the desynchronization issue can be handled by implementation.However, if “*CU UP decides to not run the compression proposed by CU CP*” means that CU UP will not process the packets in the EHC module, then there will be misalignment issues, because the UE will anyway encode/decode the packet by assuming that there are EHC headers. |
| Ericsson | Agree | RAN2 should reply something like: “For DRB configured with EHC by CU CP, UE expects for DL packets additional EHC headers and UE implementation may thus remove octets at expected EHC header position. If EHC header wasn’t included by CU UP, UE would remove erroneously Ethernet payload data.” + include a comment similar to LG’s comment. |
| MediaTek | Agree, but | This is a non-optimal solution as in the case where FH are sent for the DL, the decompressor in the UE will end up sending feedback for every DL packet. It would be better for RAN3 to fix their specs to avoid this situation in the first place, i.e. that UE is configured with EHC but NW cannot perform EHC. |
| Xiaomi | Agree/Disagree | We agree with Huawei that if the CU UP does not include the EHC header, the PDCP receiving entity will fail the decoding. |
| CATT | Agree | However, it restricts the implementation of CU UP. We can send LS to RAN3 and ask RAN3 to consider specification impact accordingly. |
| Samsung | Agree | We may not mandate the network implementation. However, if Ethernet header compression is configured, then EHC header should be generated to cope with this initial desynchronization problem. It would be better to clarify this in reply LS to RAN3. |
| Nokia, Nokia Shanghai Bell | Disagree | To avoid IODT issues, it seems to us the EHC should not be configured for the UE in case CU-UP decides not to use EHC. It should be clarified to RAN3 that in case EHC header is not appended to DL packets, then there is no possibility to recover from such situation.In any case, even though the headers were always included, there is a risk to lose multiple packets in the beginning before detecting there is no EHC feedback. |
| Intel | Agree |  |

### 3.2.2 Miscellaneous corrections

[R2-2104203](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113bis-e%5CDocs%5CR2-2104203.zip) PDCP miscellaneous corrections LG Electronics Inc. (PDCP rapporteur) CR Rel-16 38.323 16.3.0 0070 - F NR\_IIOT-Core, 5G\_V2X\_NRSL-Core Late

**Reason for change:**

1. The EHC feedback is transmitted via PDCP Control PDU, and the PDCP Control PDU is neither ciphered nor integrity protected. However, in the current PDCP specification, it is specified that ciphering is not applied but not specified that integrity protection is not applied. It could be misled that integrity protection is applied to PDCP Control PDU including EHC feedback.

2. [Editorial] “respectively” is missing for respective integrity protection and ciphering procedure.

3. The NOTE in RX\_NEXT says that “It is up to UE implementation to select HFN for RX\_NEXT as such that initial value of RX\_DELIV should be a positive value.”. This NOTE allows the UE to set its own initial HFN value by implementation. However, the initial HFN value shall be 0 for normal UEs, and the NOTE should be applied only for sidelink UEs.

**Solution:**

1. It is specified that integrity protection and verification are not applied to PDCP Control PDU including EHC feedback.

**Q4: Comments for the change 1.?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree/Agree with modification | Detailed Comments |
| LG | Agree | This is to avoid potential misinterpretation of PDCP specification. |
| Huawei, HiSilicon | Agree | Just to make the description complete |
| Ericsson | Agree | The formulation should be “..ciphered nor integrity protected.” It is not recommended to use “/” in specs. |
| MediaTek | Agree |  |
| Xiaomi | No strong view | As discussed in another email thread, companies noticed that Section 5.9 of the PDCP specification already states that “The integrity protection is not applicable to PDCP Control PDUs”. And the EHC feedback is PDCP Control PDU |
| CATT | Disagree | Same as the comments in offline#004 for ROHC feedback:1. In TS 38.323 clause 5.9, it is specified clearly that “The integrity protection is not applicable to PDCP Control PDUs.”
2. Integrity protection is identified by the MAC-I field in PDCP PDU. It seems no room for misunderstanding.
 |
| Samsung | Agree, but | We have some sympathy with the intention. It may be confused in the procedural text given that UP IP can be applied in NR. One minor comment is that it would be better to specify “integrity protection” before “ciphering” for the transmit operation, which is aligned with the general procedure. |
| Nokia, Nokia Shanghai Bell | No strong view | We tend to agree with CATT |
| Intel | Disagree | In TS 38.323 clause 5.9, it is already specified that “The integrity protection is not applicable to PDCP Control PDUs”.  |
| vivo | No strong view |  |

2. “respectively” is added for respective integrity protection and ciphering procedure.

**Q5: Comments for the change 2.?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree/Agree with modification | Detailed Comments |
| LG | Agree | This is to just clean-up of PDCP specification. |
| Huawei, HiSilicon | Agree |  |
| Ericsson | Agree |  |
| MediaTek | Agree |  |
| Xiaomi | Agree |  |
| CATT | Agree |   |
| Samsung | Agree |  |
| Nokia, Nokia Shanghai Bell | Agree |  |
| Intel | Agree |  |
| vivo | Agree |  |

3. It is specified that the NOTE in RX\_NEXT is applied only for sidelink UEs.

**Q6: Comments for the change 3.?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree/Agree with modification | Detailed Comments |
| LG | Agree | This issue was discussed in e-mail, and all companies in the e-mail agreed to this change. |
| Huawei, HiSilicon | Agree |  |
| Ericsson | Agree |  |
| MediaTek | Agree |  |
| Xiaomi | Agree |  |
| CATT | Agree |  |
| Samsung | Agree |  |
| Nokia, Nokia Shanghai Bell | Agree |  |
| Intel | Agree |  |
| vivo | Agree |  |

## 3.3 BAP

[R2-2104165](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_113bis-e%5CDocs%5CR2-2104165.zip) Miscellaneous corrections on BAP transmitting operation and default routing Huawei, HiSilicon (Rapporteur) CR Rel-16 38.340 16.4.0 0015 - F NR\_IAB-Core

**Reason for change:**

1. in Section 5.2.1.1, about the general operation of the transmitting part of the BAP entity on the IAB-MT, IAB-DU, and IAB-donor-DU:

|  |
| --- |
| The transmitting part of the BAP entity on the IAB-MT can receive BAP SDUs from upper layers and BAP Data Packets from the receiving part of the BAP entity on the IAB-DU of the same IAB-node, and construct BAP Data PDUs as needed (see clause 4.2.2). The transmitting part of the BAP entity on the IAB-DU can receive BAP Data Packets from the receiving part of the BAP entity on the IAB-MT of the same IAB-node, and construct BAP Data PDUs as needed (see clause 4.2.2). The transmitting part of the BAP entity on the IAB-donor-DU can receive BAP SDUs from upper layers. |

As described, the transmitting part of the BAP entity on the IAB-MT or IAB-DU will construct BAP Data PDUs if needed upon receiving BAP Data Packets from the receiving part of the BAP entity on the IAB-DU or IAB-MT of the same IAB node.

However, the behavior of the transmitting part of the BAP entity on the IAB-donor-DU upon receiving BAP SDUs from upper layers is missing in this specification.

**Solution:**

1. In Section 5.2.1.1, add ", and construct BAP Data PDUs as needed (see clause 4.2.2) " in the transmitting operation of BAP entity of the IAB-donor-DU.

**Q7: Comments for the change 1.?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree/Agree with modification | Detailed Comments |
| LG | Agree | It seems unintentionally missed wording. |
| Huawei, HiSilicon | Agree |  |
| Ericsson | Agree |  |
| MediaTek | Agree |  |
| Xiaomi | Agree |  |
| CATT | Agree |  |
| Samsung | agree |  |
| Nokia, Nokia Shanghai Bell | Agree |  |
| Intel | Agree |  |
| Qualcomm | Agree |  |
| vivo | Agree |  |

**Reason for change:**

2. in Section 5.2.1.3, as to the routing operation of the BAP Data PDU to be transmitted:

|  |
| --- |
| For a BAP Data PDU to be transmitted, BAP entity shall:- if the BAP Data PDU corresponds to a BAP SDU received from the upper layer, and- if the BH Routing Configuration has not been (re)configured by F1AP after the last (re)configuration of *defaultUL-BH-RLC-channel* by RRC:- select the egress link on which the egress BH RLC channel corresponding to *defaultUL-BH-RLC-channel* is configured as specified in TS 38.331 [3] for non-F1-U packets; |

According to the agreements of RAN2 109b-e, for the case that IAB-MT is in DC mode, the default BH RLC Channel refers to an RLC channel on the SCG, if the IAB-MT is operating in (NG)EN-DC, otherwise, it refers to an RLC channel on the MCG.

That is, for NR-DC, the default BH RLC Channel is only configured on the MCG. In case the MCG link experiences RLF, the routing operation for the F1-C and non-F1 traffic should be suspended.

Therefore, the routing behavior highlighted in red is only appliable for the case where the egress link is available.

**Solution:**

2. In Section 5.2.1.3, add "if available" to the default link, which corresponds to the default configuration for F1-C and non-F1 traffic when perform routing.

**Q8: Comments for the change 2.?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree/Agree with modification | Detailed Comments |
| LG | see comments | We wonder whether just adding "if available" to the current spec means suspension operation as this CR wants. Actually it seems IAB node’s behavior is undefined when the MCG link experiences RLF. A NOTE may be helpful to address this without the proposed change, i.e., "if available". |
| Huawei, HiSilicon | Agree | LG’s understanding above is correct. In this case mentioned in the CR, i.e. RLF happens at the concerned link, it is better to hold on and not to process the packets at BAP; otherwise, the packets may be dropped unnecessarily.We think adding “if available” would be simpler than adding a note, and “if available” has already been clarified in the note.NOTE 1: An egress link is not considered to be available if the link is in BH RLF. |
| Ericsson  | Disagree | The change does not seem to be necessary. The NOTE1 already captures the case in which the egress link should be considered not available. Since IAB node´s behavior is left anyhow unspecified, this change is not necessary |
| MediaTek | Agree |  |
| Xiaomi | Agree |  |
| CATT | Agree | We are OK to add “if available”. |
| Samsung |  | As LG commented, just adding “if available” is not sufficient to reflect some suspension operation, and agree with that this case is not defined yet. NOTE with sufficient description might be better while the detail description is FFS. |
| Nokia | Disagree | This seems quite a corner case, given the "after the last (re)configuration of defaultUL-BH-RLC-Channel by RRC". What is the use case? MCG RLF before routing reconfig by F1AP but after the "last (re)configuration of defaultUL-BH-RLC-Channel by RRC"? |
| Intel | Agree |  |
| Qualcomm | Agree |  |
| vivo | Agree |  |

**Reason for change:**

3. in Section 5.2.1.4.2, an editorial change is needed:

|  |
| --- |
| - for the BAP SDU encapsulating non-F1-U packet: |

The word "a" is missing before the "non-F1-U packets".

**Solution:**

3. In Section 5.2.1.4.2, add "a" before the "non-F1-U packets".

**Q9: Comments for the change 3.?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree/Agree with modification | Detailed Comments |
| LG | Agree  | This is to just clean-up of BAP specification. |
| Huawei, HiSilicon | Agree |  |
| Ericsson | Agree | Useful editorial correction |
| MediaTek | Agree |  |
| Xiaomi | Agree |  |
| CATT | Agree |  |
| Samsung | Agree |  |
| Nokia | Agree but | In case other changes are agreed, can fix this. Not critical. |
| Intel | Agree |  |
| vivo | Agree |  |

**Reason for change:**

4. in Section 5.2.2, some editorial changes are needed:

|  |
| --- |
| Upon receiving a BAP Data PDU from lower layer (i.e. ingress BH RLC channel), the receiving part of the BAP entity shall:- if DESTINATION field of this BAP PDU matches the BAP address of this node:- remove the BAP header of this BAP PDU and deliver the BAP SDU to upper layers;- else:- deliver the BAP Data Packet to the transmitting part of the collocated BAP entity. |

The word "data" is missing between the "BAP" and "PDU".

**Solution:**

4. In Section 5.2.2, add "data" between the "BAP" and "PDU".

**Q10: Comments for the change 4.?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree/Agree with modification | Detailed Comments |
| LG | Agree  | This is to just clean-up of BAP specification. |
| Huawei, HiSilicon | Agree |  |
| Ericsson | Agree | Useful editorial correction |
| MediaTek | Agree |  |
| Xiaomi | Agree |  |
| CATT | Agree |  |
| Samsung | Agree  | Moreover, 5.2.1.1 saying “BAP Data Packet” also need to be revised as “BAP Data PDU” for the consistency. |
| Nokia | Agree but | In case other changes are agreed, can fix this. Not critical, obvious from the preceding text that makes it about Data PDUs. |
| Intel | Agree |  |
| vivo | Agree |  |

# 4 Conclusion

TBD