3GPP TSG-RAN WG2 #111-e R2-200xxxx

Electronic Meeting, 17th – 28th August 2020

Agenda Item: 6.5.4.2

Source: Samsung

Title: [AT111-e][034][IIOT] EHC Corrections

Document for: Discussion, Decision

# 1 Introduction

This document is to handle the following email discussion:

* **[AT111-e][034][IIOT] EHC Corrections (Samsung)**

Scope: Take into account on-line outcome, Treat R2-2008044, 6728, 8030, 8034, 8035

Determine agreeable parts, Agree CRs

Intermediate Deadline (for companies’ feedback): Aug 25 (Tue) 0900 UTC

Deadline: Aug 27 0900 UTC, Intermediate deadlines by Rapporteur if needed.

# 2 Discussion

The rapporteur encourages the delegates who provide input to provide their contact information in the below table:

|  |  |
| --- | --- |
| Company | Delegate contact |
| Samsung (Rapporteur) | Donggun Kim (s\_dg.kim@samsung.com) |
| LGE | Geumsan Jo (geumsan.jo@lge.com) |
| Mediatek | Pradeep Jose (pradeep.jose@mediatek.com) |
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| Fujitsu | Ohta (ohta.yoshiaki@fujitsu.com) |

Companies are requested to give their comments for each of the treated issues of this email discussion in the tables below.

## 2.1 NR related issue

[R2-2006728](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_111-e%5Cdocs%5CR2-2006728.zip) Correction on receive opearation when both EHC and out-of-order delivery are configured for a DRB Huawei, HiSilicon CR Rel-16 38.323 16.1.0 0050 - F NR\_IIOT-Core

**Reason for change** : In the current spec, there is a restriction that RoHC and *outOfOrderDelivery* for PDCP cannot be simultaneously configured for a DRB. When *outOfOrderDelivery* for PDCP is configured for a DRB, a received PDCP Data PDU can be directly delivered to upper layers after performing deciphering and integrity verification, as long as the received PDU is located within the reception window. However, for Ethernet header decompression, there is no restriction that EHC and *outOfOrderDelivery* for PDCP cannot be simultaneously configured for a DRB. When both EHC and *outOfOrderDelivery* for PDCP are configured for a DRB, a received PDCP Data PDU can be delivered to upper layers after performing deciphering integrity verification, as well as Ethernet header decompression.

**Summary of change** : In clause 5.2.2.1,

“- if *outOfOrderDelivery* is configured:

 - deliver the resulting PDCP SDU to upper layers.” is modified as

“- if *outOfOrderDelivery* is configured:

 - deliver the resulting PDCP SDU to upper layers after performing EHC header decompression, if configured.”

*Rapporteur comment: In NR, header decompression procedure was not specified for the case that PDCP out-of-order delivery is configured since it can cause possible header decompression failure and latency issue, which ended up with restriction of configuration, i.e. ROHC cannot be configured with PDCP out-of-order delivery. The rapporteur thinks that the same principle as ROHC can be applied to EHC, i.e. restriction of configuration. However, if most companies don’t want to have such restriction, then it seems straightforward to accept this CR. Please share your views.*

|  |  |  |
| --- | --- | --- |
| Company | Agree CR?(Yes or No) | Comments |
| LG | No | In NR, the ROHC is not configured when the out-of-order delivery in PDCP is configured. We think that the same principle can be applied to the EHC. In addition, if this CR is agreed, RAN2 should consider the EHC header decompression failure when the out-of-order delivery is configured. For example, if a PDCP PDU with compressed header is received before the header context is not established, the PDCP PDU would be discarded due to EHC decompression failure. This case may happen because the RLC entity performs the out-of-order delivery in NR. Thus, we think that the simultaneous configuration of EHC and out-of-order delivery should not be supported.In order to prevent the simultaneous configuration of EHC and out-of-order delivery, we prefer to change the RRC specification as follows.***ehc-Common***Indicates the configurations that apply for both downlink and uplink. Network configures *ehc-Common* to *notUsed* when *outOfOrderDelivery* is configured.***ehc-Downlink***Indicates the configurations that apply for only downlink. If the field is configured, then Ethernet header compression is configured for downlink. Otherwise, it is not configured for downlink. Network configures *ehc-Downlink* to *notUsed* when *outOfOrderDelivery* is configured. |
| Samsung | No strong opinion | We tended to agree with LG. Now, we think Huawei and Nokia have a point below. This CR is acceptable to us.  |
| Mediatek | Yes | Support this CR. EHC has been defined for IIoT use-cases, where the type of communication is URLLC. In order to meet URLLC deadlines, reordering delays are simply unacceptable. Therefore out-of-delivery must be supported alongside EHC. |
| Huawei (proponent) | Yes | This CR is about when out-of-order delivery is configured simultaneously with EHC, the missing texts shall be added. We can discuss whether or not configured out-of-order delivery together with EHC however it is out of scope of this one. If RAN2 decides to not allow out-of-order delivery together with EHC, we can then simply removed these texts here while adding e.g. what LG proposed above. On whether or not to configure EHC and PDCP out-of-order delivery simultaneously: For TSN service, we assume the application layer can benefit from e.g. time stamp such that PDCP out-of-order delivery won’t be big issue for service performance as re-ordering could be done by the application layer; if out-of-order delivery is not to use, one missing PDCP PDU would delay the delivery of other PDCP PDUs which are correctly received, this would not be desirable.  |
| Ericsson | Yes | Support this CR. The error case mentioned by LG can be avoided by network implementation. Network only sends the compressed packet after receiving the feedback that the context is established, the same as specifed UE behaviour copied below.The EHC compressor keeps transmitting the FH packets until the EHC feedback is received from the EHC decompressor.  |
| Sharp | Yes | It should be left for NW implementation, e.g., based on the QoS of the DRB, to decide if out-of-order delivery together with EHC configured or not. |
| vivo | No | We agree with LG. |
| OPPO | No | From our perspective, before we agree the CR, the first question should be whether to support EHC and out-of-order simultaneously. Regarding simultaneous configuration, we prefer to follow the principle as RoHC. |
| Qualcomm | Yes | Agree with the reasoning from Ericsson and Mediatek. There is no extra receiver complexity by accepting this CR. The EHC function continues to operate as usual. |
| Nokia | Yes | Support this CR.EHC and Out of order delivery can be configured simultaneously for EHC since it only consists of static compressed header. ROHC and Out of sequence delivery cannot be configured simultaneously since it may lead to decompression failure in some scenarios due to dynamic part in the compressed header. In EHC, the transmitter does not send compressed header unless the receiver sends the feedback, hence the issue mentioned by LG will never occur. |
| Intel | Yes | Regarding the error case mentioned by LG (whether it is possible that PDCP PDU with compressed header is received before the header context is not established), there are two cases. * + - * 1. There is no CID overwriting. In this case, the error case cannot happen as explained by Ericsson.
				2. There is CID overwriting. In the online discussion, it seems that most companies think the issue can be avoided by a proper implementation, e.g. as from Chair notes “- Chair: Seems 3 may be the way an implementation could resolve this.”

In summary, with proper implementation, the error case mentioned by LG can be avoided.  |
| DOCOMO | Yes | Agree with Ericsson. In addition, RoHC may target sequential fields for compression (i.e. order is important), while EHC doesn’t (Ethernet is a protocol that does not guarantee packet order). So we think it is not necessary that the same principle (i.e. RoHC) can be applied to the EHC in this case.  |
| Fujitsu | No | The out-of-order should not be allowed. If allowed, decompressor implementation becomes complex in terms of EHC context handling e.g. EHC context overriding. The complexity reduction is important to us.In addition to cases mentioned in R2-2006725 (i.e. FH packet is missing), CH packet retransmission needs to be considered:(1) A case is EHC context update with same CID:Com ========= 1. CIDx/CH/InitTx (old context) ======> Dec old CID=x ========= 2. CIDx/FH/Payload (new context) ======> <======== 3. Feedback = CIDx (new context) ================ 4. CIDx/CH/Payload (new context) ======> new CID=x ========= 5. CIDx/CH/ReTx (old context) =======> new CID=x=> ReTx 5 wrongly uses new context (it must use old context but it is flushed out)(2) Another case is EHC context update with different CID:Com ========= 1. CIDx/CH/1stTx (old context) ======> Dec CID=x ========= 2. CIDy/FH/Payload (new context) ======> <======== 3. Feedback = CIDy (new context) ================ 4. CIDy/CH/Payload (new context) ======> CID=y ========= 5. CIDx/CH/ReTx (old context) =======> CID=x=> ReTx 5 may correctly use CID=x but it is only valid if CID=x was not replaced with other CID.Therefore, 38323 should specify such a restriction to avoid the above two cases. The restriction is also useful from the perspective that the EHC context needs to be updated when all old CH packets have been received in decompressor. |

Summary : The rapporteur does not see a critical issue to configure EHC and NR PDCP out-of-order delivery simultaneoulsy, based on most companies’ comments. At least, several concerned issues can be handled by implementation. Moreover, the majority view (8 out of 12 companies) prefer to allow such configuration and thus the rapporter suggests the following proposal:

**Proposal 1. Agree to R2-2006728 (However, this CR needs to be revised with new tdoc number**(**R2-2008479) to enhance the CR quality, e.g. word style is not aligned with the current specification).**

## 2.2 LTE related issues

LTE EHC for Split and LWA DRBs

[R2-2008036](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_111-e%5Cdocs%5CR2-2008036.zip) LTE EHC configuration for split and LWA DRBs Samsung discussi

- LG support, vivo as well.

* EHC is not supported for split and LWA DRBs.

[R2-2008044](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_111-e%5Cdocs%5CR2-2008044.zip) CR on LTE EHC configuration Samsung CR Rel-16 36.331 16.1.1 4422

|  |
| --- |
| ***ethernetHeaderCompression***This field configures Ethernet Header Compression. This field can only be configured for DRB.E-UTRAN does not reconfigure *ethernetHeaderCompression* for an MCG DRB except for upon handover and upon the first reconfiguration after RRC connection re-establishment. E-UTRAN does not reconfigure *ethernetHeaderCompression* for a SCG DRB except for upon SCG change involving PDCP re-establishment.E-UTRAN does not configure this field if *uplinkDataCompression* is configured. E-UTRAN does not configure this field for the split and LWA DRBs*.* |

*Rapporteur comment: R2-2008044 is a corresponding CR for R2-2008036, which of the principle was already discussed and agreed on-line. Please share your views if the CR is acceptable or the update is needed.*

|  |  |  |
| --- | --- | --- |
| Company | Agree CR?(Yes or No) | Comments |
| LG | Yes |  |
| Samsung | Yes (Proponent) |  |
| MediaTek | Yes | Minor correction – ‘E-UTRAN does not configure this field for ~~the~~ split and LWA DRBs’ |
| Huawei | Yes |  |
| Ericsson | Yes | Minor comment: The first version of the CR is “- “, not “0“ |
| Sharp | Yes |  |
| vivo | Yes |  |
| OPPO | Yes |  |
| Nokia | Yes |  |
| Intel | Yes |  |
| DOCOMO | Yes |  |

Summary : All the companies’views are well aligned and thus the rapporteur suggests the following proposal:

**Proposal 2. Agree to R2-2008044 (However, this CR needs to be revised with new tdoc number**(**R2-** **2008480) to enhance the CR quality based on companies’ comments).**

[R2-2008030](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_111-e%5Cdocs%5CR2-2008030.zip) EHC decompression failure at LTE PDCP re-establishment Samsung discussion NR\_IIOT-Core

**Observations**: Before RAN2#110, LTE PDCP t-reordering was used only for split and LWA DRBs and the header compression could not be configured for split and LWA DRBs. So LTE PDCP re-establishment when t-Reordering is used (Section 5.2.2.1a in 36.323) didn’t have to consider header decompression procedure. However, according to agreed CRs R2-2004818 and R2-2004826 in RAN2#110, LTE PDCP t-reordering can be used for normal AM DRB if LTE RLC out-of-order delivery is configured. As in legacy, the header compression can be configured for AM DRB as well. Therefore, LTE PDCP re-establishment when t-Reordering is used (Section 5.2.2.1a in 36.323) should get to consider header decompression procedure for normal AM DRB, e.g. header compression protocol reset procedure. Moreover, due to LTE RLC out-of-order delivery and LTE PDCP t-reordering function, the header decompression failure can happen as in NR(NR RLC is mandatory with out-of-order delivery and NR PDCP works with t-Reordering as default).

**Proposal**: The simple solution is to apply the same solution to LTE as NR since RAN2 already discussed the same issue and agreed to the solution in the early stage of NR. The only difference is that this issue happens in LTE only if LTE RLC out-of-order delivery is configured.

*Rapporteur comment: RAN2 discussed the same issue in the early stage of NR. In LTE, we now encounter this issue due to addition of LTE functions. The rapporteur thinks that we can follow the NR principle. Even if most companies want to deviate from NR, we should at least specify EHC protocol reset procedure at LTE PDCP re-establishment (Section 5.2.2.1a in 36.323). Please share your views.*

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| --- | --- | --- |
| Company | Agree CR?(Yes or No) | Comments |
| LG | No | Considering the agreement on that EHC is not supported for split and LWA DRBs, the EHC would not be configured when the t-Reordering is configured. In other words, the network should not simultaneously configure the out-of-order delivery in RLC and t-Reordering in PDCP. This is because the out-of-order delivery in RLC should be configured only when the t-Reordering in PDCP is configured. Thus, we do not see a need of the changes. |
| Samsung | Yes | Reply to LG: The contribution is not related to the agreement that EHC is not supported for split and LWA DRBs. The contribution is to resolve the issue for normal AM DRBs configured with RLC out-of-order delivery (and t-reordering) and EHC, Not for split and LWA DRBs. According to agreed LTE CRs from RAN2#110e, we need to note that t-Reordering is used if the associated RLC entity is configured with RLC out-of-order delivery for normal AM DRB. Moreover, EHC can be configured for normal AM DRB as follows: 5.1.2.1.4 Procedures for DRBs mapped on RLC AM or RLC UM, for LWA bearers and SLRB when the reordering function is usedFor 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 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 configured with PDCP duplication; or- the PDCP entity is reconfigured to configure DAPS; or- the PDCP entity is associated with at least one RLC entity configured with *rlc-OutOfOrderDelivery*.

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| ***rlc-OutOfOrderDelivery***Indicates that out-of-order delivery from RLC to PDCP is configured for this RLC entity as specified in TS 36.322 [7]. |

 t-Reordering-r12 ENUMERATED { ms0, ms20, ms40, ms60, ms80, ms100, ms120, ms140, ms160, ms180, ms200, ms220, ms240, ms260, ms280, ms300, ms500, ms750, spare14, spare13, spare12, spare11, spare10, spare9, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1} OPTIONAL -- Cond SetupS

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| --- | --- |
| *SetupS* | The field is mandatory present in case of setup of or reconfiguration to a split DRB or LWA DRBas well as in case of setup of or reconfiguration to a DRB associated with at least one RLC entity configured with *rlc-OutOfOrderDelivery*. The field is optionally present upon reconfiguration of a split DRB or LWA DRB or upon DRB type change from split to MCG DRB or from LWA to LTE only as well as upon reconfiguration of a DRB associated with at least one RLC entity configured with *rlc-OutOfOrderDelivery*, need ON. Otherwise the field is not present. |

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| --- |
| ***ethernetHeaderCompression***This field configures Ethernet Header Compression. This field can only be configured for DRB.E-UTRAN does not reconfigure *ethernetHeaderCompression* for an MCG DRB except for upon handover and upon the first reconfiguration after RRC connection re-establishment. E-UTRAN does not reconfigure *ethernetHeaderCompression* for a SCG DRB except for upon SCG change involving PDCP re-establishment.E-UTRAN does not configure this field if *uplinkDataCompression* is configured. |

 |
| MediaTek | Yes | Agree with Samsung |
| Huawei | Yes | Agree with Samsung.  |
| LG |  | Reply to SamsungWe understood your intension.However, according to the LTE RRC specification, there is a restriction on that “E-UTRAN does not configure ROHC while t-Reordering is configured”. With this reason, a PDCP entity configured with t-Reordering does not decompress the PDCP PDUs compressed by ROHC at re-establishment.

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| --- |
| ***profiles***The profiles used by both compressor and decompressor in both UE and E-UTRAN. The field indicates which of the ROHC profiles specified in TS 36.323 [8] are supported, i.e. value *true* indicates that the profile is supported. Profile 0x0000 shall always be supported when the use of ROHC is configured. If support of two ROHC profile identifiers with the same 8 LSB's is signalled, only the profile corresponding to the highest value shall be applied. **E-UTRAN does not configure ROHC while t-Reordering is configured** (i.e. for split DRBs, for LWA bearers or upon reconfiguration from split or LWA to MCG DRB). |

We think that the same principle should be applied to the EHC because, from the configuration point of view, there is no difference between ROHC and EHC. Thus, we propose the change of the RRC specification as follow.

|  |
| --- |
| ***ethernetHeaderCompression***This field configures Ethernet Header Compression. This field can only be configured for DRB.E-UTRAN does not reconfigure *ethernetHeaderCompression* for an MCG DRB except for upon handover and upon the first reconfiguration after RRC connection re-establishment. E-UTRAN does not reconfigure *ethernetHeaderCompression* for a SCG DRB except for upon SCG change involving PDCP re-establishment.E-UTRAN does not configure this field if *uplinkDataCompression* is configured**. E-UTRAN does not configure this field while t-Reordering is configured (i.e. for AM and UM DRBs, for split DRBs, for LWA bearers or upon reconfiguration from split or LWA to MCG DRB).** |

With above change, we do not need to change the PDCP specification for this issue. |
| Samsung  |  | Reply to LG: We are talking about EHC issues. There are quite many different configurations between ROHC and EHC. For example, drb-ContinueROHC cannot be configured for UL and DL, separately while drb-ContinueEHC-DL and drb-ContinueEHC-UL can be configured for UL and DL, separately. (Note that the intention for ROHC restriction was for split and LWA DRBs long time ago since t-reordering was used only for split and LWA DRBs at that time. Now, we can use it for normal AM DRBs as well) In Rel-16, EHC is applied to LTE and NR. LG’s proposal is that EHC cannot be configured with t-Reordering in LTE while EHC can be configured with t-Reordering in NR, which causes different configuration between LTE eNB and NR gNB. Moreover it could have impacts on EN-DC or inter-RAT handover. We don’t prefer such strong restriction for LTE EHC unlike NR EHC.  |
| Ericsson | Yes | Agree with Samsung and we would like to align with the NR  |
| Sharp | Yes | Agree with Samsung. |
| vivo | Yes | Agree with Samsung |
| OPPO | Yes | Agree with Samsung |
| Nokia | Yes | Agree with Samsung |
| Intel | Yes | Agree with Samsung. |
| DOCOMO | Yes | Agree with Samsung |

[R2-2008034](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_111-e%5Cdocs%5CR2-2008034.zip) CR on LTE PDCP re-establishment when t-Reordering is used Samsung CR Rel-16 36.323 16.1.0 0290 - F NR\_IIOT-Core

#### 5.2.2.1a Procedures for DRBs mapped on RLC AM while the reordering function is used

When upper layers request a PDCP re-establishment while the reordering function is used, the UE shall:

- process the PDCP Data PDU(s) that are received from lower layers due to the re-establishment of the lower layers, as specified in the clause 5.1.2.1.4;

- if the PDCP entity is to be associated with one AM RLC entity after PDCP re-establishment:

- stop and reset *t-Reordering*;

- if the PDCP entity is associated with at least one RLC entity configured with *rlc-OutOfOrderDelivery*:

- perform header decompression using EHC for all stored PDCP SDUs if *drb-ContinueEHC-DL* is not configured in TS 36.331 [3];

- reset the EHC protocol for downlink (if configured) if *drb-ContinueEHC-DL* is not configured, see TS 36.331 [3];- apply the ciphering algorithm and key provided by upper layers during the re-establishment procedure.

*Rapporteur comment: R2-2008034 is a corresponding CR for R2-2008030, which is composed of the procedure avoiding EHC decompression failure and EHC protocol reset procedure. One thing we need to note is that we are trying to resolve the issue for the case that LTE RLC out-of-order delivery is configured. Please share your views.*

|  |  |  |
| --- | --- | --- |
| Company | Agree CR?(Yes or No) | Comments |
| LG | No | See the above comment. |
| Samsung | Yes |  |
| MediaTek | Yes |  |
| Huawei | Yes | We think this CR is on the similar line of thinking as that of the first CR. |
| Ericsson | Yes |  |
| Sharp | Yes |  |
| vivo | Yes |  |
| OPPO | Yes |  |
| Nokia | Yes  |  |
| Samsung |  | Reply to Nokia: In your text proposal, I assume you may regard RLC out-of-order delivery as PDCP out-of-order delivery. In NR, we have the similar context in 38.323 since we have NR PDCP out-of-order delivery configuration. However, in LTE, PDCP out-of-order delivery is not allowed. If the associated RLC entity is configured with RLC out-of-order delivery, then the PDCP entity always uses t-Reordering. So there is no issue for normal operation. Here, the concerned issue is about PDCP re-establishment procedure if the associated RLC entity is configured with RLC out-of-order delivery, e.g. upon the reception of handover command.We think it should be specified in Section 5.2.2.1a and nothing is needed for Section 5.1.2.1.4.1Nokia: Yes we agree, now we have revised our response. |
| Intel | Yes |  |
| DOCOMO | Yes |  |

Summary : Most companies’views are well aligned and thus the rapporter suggests the following proposal:

**Proposal 3. Agree to R2-2008034.**

# Conclusion

The rapporteur concludes this email discussion as follows:

**Proposal 1. Agree to R2-2006728 (However, this CR needs to be revised with new tdoc number**(**R2-2008479) to enhance the CR quality, e.g. word style is not aligned with the current specification).**

**Proposal 2. Agree to R2-2008044 (However, this CR needs to be revised with new tdoc number**(**R2-** **2008480) to enhance the CR quality based on companies’ comments).**

**Proposal 3. Agree to R2-2008034.**

NOTE : For your information, the scope of this email discussion is to treat R2-2006728, R2-2008044, R2-2008030, R2-2008034, and R2-2008035. Note that R2-2008030 is a discussion paper related to R2-2008034 while R2-2008035 has been withdrawn.

# References