**3GPP T****SG-RAN WG2 Meeting #117-electronic R2-220xxxx**

**Online, February 21st - March 3rd, 2022**

**Agenda item: 6.1.3**

**Source: vivo**

**Title: Report of [AT117-e][030][NR16] User-plane Related Corrections**

**Document for: Discussion and Decision**

# 1 Introduction

This contribution is aimed at reporting the discussion and results of the following email discussion:

* [AT117-e][030][NR16] User-plane Related Corrections (vivo)

 Scope: Treat R2-2202524, R2-2202110, R2-2202326 (RRC CR), R2-2203484, R2-2203131.

 Ph1 Determine agreeable parts. P2 agree CRs for agreeable parts.

 Intended outcome: Report, Agreed CRs.

 Deadline: Schedule 1

The discussion scope is to gather companies’ views on the contributions [2]-[5]. Companies are invited to provide their views by February 24th (Thursday), 2022, 12:00 UTC for phase-1 discussion.

# 2 Participants

To facilitate this offline discussion amongst the delegates, would you please fill in your name and email address in the table below.

|  |  |
| --- | --- |
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|  |  |

# 3 Discussion

## 3.1 UL skipping (MAC aspect)

In contribution [2], it is proposed that a procedure level alignment should be introduced to make the branches of both enhanced and legacy UL skipping symmetric (i.e. the two branches for enhanced UL skipping in Rel-16 and legacy UL skipping in Rel-15 should follow a common method of description.). More specifically, the following changes are proposed,

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| --- |
| **TS 38.321 clause 5.4.3.1.3:**The MAC entity shall:1> if the MAC entity is configured with *enhancedSkipUplinkTxDynamic* with value *true* and the grant indicated to the HARQ entity was addressed to a C-RNTI, or if the MAC entity is configured with *enhancedSkipUplinkTxConfigured* with value *true* and the grant indicated to the HARQ entity is a configured uplink grant:2> if there is no UCI to be multiplexed on this PUSCH transmission as specified in TS 38.213 [6]; and2> if there is no aperiodic CSI requested for this PUSCH transmission as specified in TS 38.212 [9]; and2> if the MAC PDU includes zero MAC SDUs; and2> if the MAC PDU includes only the periodic BSR and there is no data available for any LCG, or the MAC PDU includes only the padding BSR:3> not generate a MAC PDU for the HARQ entity.1> else if the MAC entity is configured with *skipUplinkTxDynamic* with value *true* and the grant indicated to the HARQ entity was addressed to a C-RNTI, or the grant indicated to the HARQ entity is a configured uplink grant:2> if there is no aperiodic CSI requested for this PUSCH transmission as specified in TS 38.212 [9]; and2> if the MAC PDU includes zero MAC SDUs; and2> if the MAC PDU includes only the periodic BSR and there is no data available for any LCG, or the MAC PDU includes only the padding BSR:3> not generate a MAC PDU for the HARQ entity. |

**Q1: Do companies agree with the intention of CR R2-2202524?**

|  |  |  |
| --- | --- | --- |
|  **Company** | **Yes/No/Comments** | **Detailed comments** |
| Samsung | No strong view | No strong view. The category D CR is not essential but can be merged into other CR? |
| CATT | No | This CR doesn’t fix any critical issue in UE behavior. So it is not needed. |
| vivo | Comments | It is more like editorial correction, rather than essential correction. Anyway, we can follow the majority view.  |
| Huawei, HiSilicon | Not essential | We prefer to keep the R15 branch as it is given no functional change  |
| Nokia | No need | Cat D CR without behavioral change thus not needed. Same TP was discussed at the time when this was added (RAN2 #113e, R2-2102458) and went with current wording.  |
| OPPO | No need | It is just an editorial modification and we prefer to keep the R15 branch. |
| Qualcomm | Neutral | We can go with the majority view. Maybe it can be handled in the rapporteur’s CR? |
| Apple | Yes | This CR has no functional impact and there should not be any risk associated with the adjustment. The CR is meant to enhance the consistency of the specification. We are fine to merge it into another CR, as suggested by Samsung and Qualcomm. Basically two things are addressed:1) Both branches are made symmetric and the logical AND at the end of the line with the “else if” becomes intuitively visible.2) It makes it clear that *skipUplinkTxDynamic* should be checked first, before evaluating any of the other conditions in the branch. (We understand the existing text supports this as an intention, but it can be formulated more clearly.) |
| Intel | No strong view | The CR introduces format alignment, not behavior change. |
| ZTE | No need |  |
| LG | Yes | Though the CR has no impact on funtional behavior, we think it is good to keep the same structure on UL skpping between R15 version and R16 version for future maintenance. As this is Cat D CR, it is desirable to merge to other CR. |
| Docomo | Maybe yes | Fine to have it merged in another CR. |
| Ericsson | No strong view | Agree with Samsung  |
| MediaTek | No strong view | Agree with Samsung |
| Xiaomi | No strong view | Editorial change, the CR rapporteur can handle it. |

**Summary:**

## 3.2 UL skipping (RRC aspect)

In the LS R2-2202110 [1], it is indicated that RAN1 cannot confirm RAN2’s WA on LCH based priority has higher priority than UL skipping, and would like to inform RAN2 that RAN1 has concluded that when lch-basedPrioritization is configured, Rel-16 UL skipping cannot be enabled in Rel-16. RAN1 expects RAN2 to capture the above configuration restriction in TS 38.331.

Therefore, the correction RRC CR R2-2202326 [3] clarifies that the network does not configure *lch-BasedPrioritization* with *enhancedSkipUplinkTxDynamic* simultaneously nor *lch-BasedPrioritization* with e*nhancedSkipUplinkTxConfigured* simultaneously, as follows,

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| --- |
| **TS 38.331 sub-clause 6.3.2 *MAC-CellGroupConfig******lch-BasedPrioritization***If this field is present, the corresponding MAC entity of the UE is configured with prioritization between overlapping grants and between scheduling request and overlapping grants based on LCH priority, see TS 38.321 [3]. The network does not configure *lch-BasedPrioritization* with *enhancedSkipUplinkTxDynamic* simultaneously nor *lch-BasedPrioritization* with *enhancedSkipUplinkTxConfigured* simultaneously. |

**Q2: Do companies agree with the intention of CR R2-2202326?**

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| --- | --- | --- |
| **Company** | **Yes/No/Comments** | **Detailed comments** |
| Samsung | Yes | We agree that the RAN1 conclusion should be captured.  |
| CATT | Yes | RAN1 agreement needs to be captured in RRC as a configuration restriction. |
| vivo | Yes | We agree with the RAN1 suggestion (i.e. capturing the configuration limitation in RRC spec) and are fine with the text proposal.  |
| Huawei, HiSilicon | Yes | Fine with us |
| Nokia | Yes |  |
| OPPO | Yes |  |
| Qualcomm | Yes | We agree with the TP. But the LS in the “Reasons for change” should be R1-2112862 instead of R1-2106370.  |
| Apple | See comment | From a system’s perspective unfortunately this update may lead to a situation where the UE/gNB has to choose between either a latency-friendly or a power save friendly config, which is not preferred in our view. Besides the UL grant prioritization in MAC falls back to Rel-15 when *lch-basedPrioritization* is not configured. If DG and CG overlap and the CG has the UCI then the DG is anyway going to take precedence. Thus, an occasional de-prioritization of a PUSCH with UCI can not be avoided in any case. We nevertheless respect RAN1’s view. |
| Intel | Yes |  |
| ZTE | Yes | Fine to have this |
| LG | Yes |  |
| Docomo | Yes |  |
| Ericsson | Yes |  |
| MediaTek | Yes | This correctly captures RAN1’s conclusion |
| Xiaomi | Yes |  |

**Summary:**

## 3.3 DRX with bundling

According to the current MAC spec, *drx-HARQ-RTT-TimerUL* is started in the first symbol after the end of the first transmission (within a bundle) and *drx-RetransmissionTimerUL* is consequently started when *drx-HARQ-RTT-TimerUL* expires. With this, the gNB can configure the UE to monitor for cancellation indication for early termination of repetitions, which saves some energy for not always transmitting all repetitions but costs some extra energy to monitor for the cancellation indications until a repetition is successful.

In contribution [4], it considers that, for services where the UE energy consumption and coverage performance are of higher importance than the delay (like voice in normal operation), all repetitions are most likely needed. This means that the energy savings by using cancellation indication is much less as most of the time the link adaptation has selected the correct number of repetitions. Based on this, to save UE energy, it is proposed that the *drx-HARQ-RTT-TimerUL* shall be started after the end of the last transmission (within a bundle). The detailed proposal is listed as follows,

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| **Proposal 1: Introduce a new UE capability to allow a new optional RRC parameter to enable the start of the *drx-HARQ-RTT-TimerUL* after the end of the last transmission (within a bundle) instead of after the end of the first transmission (within a bundle).** |

**Q3: Do companies agree with the proposal 1 given in R2-2203484?**

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| --- | --- | --- |
|  **Company** | **Yes/No/Comments** | **Detailed comments** |
| Samsung | No | - This proposal is an optimization for infrequent case (high repetition factor and very short DRX Retransmission Timer, so we think it’s not an essential correction. Also note that, in most cases, when PDCCH for new transmission is received, *drx-InactivityTimer* is restarted and all retransmissions will occur while *drx-InactivityTimer* is running, so the proposal seems to optimize the infrequent case.- Considering practically used value of the Retransmission Timer, e.g. sl6-sl16, UE can most likely have a change for retransmission. - It has been almost two years since Rel-16 stage-3 is frozen. This late-stage change is not desirable. |
| CATT | No | This is a non-critical optimization. |
| vivo | Comments | We share a similar with Samsung and CATT that the proposal is a further optimization, instead of essential correction for Rel-16 spec. In this sense, we think it might be better to postpone this discussion in Rel-16 and move this to TEI 17 session.  |
| Huawei, HiSilicon | Agree with the intention | We share the intention of this proposal, which is similar to what CE topic discussed for CR timer in support of Msg3 repetition.  |
| Nokia | Yes |  |
| OPPO | No | Similar view as Samsung |
| Qualcomm | See comment | We tend to agree with the intention of the proposal. However, we think the arguments are relevant only to dynamic grants. For a configured grant, its repetition factor is RRC configured and static. Hence the argument behind the proposal does not apply. In addition, the proposed change may disable the use of CG-DFI, which is used by network to early terminate a CG’s repetition. That is because if UE has to wait till the end of repetitions to start UL RTT timer, it is no longer able to monitor CG-DFI before end of its repetition. |
| Ericsson (Robert) | Yes (proponent) | The R16 feature of repetition factor in DCI is broken as it can not be used when maximum energy saving is needed. A very common such use case is voice services where delay and rate requirements are well known. It is not an infrequent use case, it is for all repetition factors when controlled in the DCI – then the drx-RetransmissionTimerUL must be extended to cover all repetition factors that are intended to be used – else the UE may be unreachable for retransmissions. During a voice talk spurt the voice encoder produce a packet every 20 or 40 ms. For energy saving the drx-InactivityTimer setting will be very short, only a few ms, and the drx-RetransmissionTimerUL only 2 or 4 slots (if not extended to cover all repetition factors), and using a drx cycle for the UE to wake up only for a few slots every 40 ms to listen to PDCCH. This proposal is valid for both dynamic and configured grants. As voice is predictable it is very suitable for configured grants, and CG can be used with repetition factor in DCI – then RRC reconfiguration of the drx parameters must be avoided and maximum energy saving shall be applied.About CG-DFI, when repetitions are cancelled, the cancellation arrives at the UE about half a HARQ RTT after the transmission that was successfully decoded in the gNB, that is using CG-DFI always means about 3 unnecessary repetitions (assuming a HARQ RTT of 6 slots, and that the UE can cancel repetitions immediately after it receives the cancellation indication). Further, when repetition factor is controlled in the DCI the link adaptation (as always for CG) will need to sometimes select a different repetition factor and thus send a new CG activation. There is no value in using CG-DFI when delay is less important than the energy consumption as the link adaptation usually select the correct number of repetitions, and with this proposal, the UE do not need to monitor the PDCCH for CG-DFI nor send unnecessary repetitions which will save energy. |
| Intel | No | Our understanding is that the proposed use case (all repetitions are most likely needed) can be supported by existing mechanism of starting *drx-HARQ-RTT-TimerUL* after the end of the first transmission. *drx-HARQ-RTT-TimerUL* can be set based on the bundle duration and necessary processing time at gNB side so that *drx-RetransmissionTimerUL* can be started in suitable timing. |
| ZTE | No | This is an optimization and which can be discussed in TEI. |
| LG | No | The proposal seems an optimization because we believe the network can adjust DRX retransmission timer not to be expired during repetition. In addition, even though the proposal could help UE power saving where repetition is required, CG-DFI provides an opportunity of early termination for repetition (i.e., within a bundle).  |
| Docomo | Yes | One of the proponents. |
| MediaTek | No | Starting the RTT timer after the first transmission was intentional to allow early termination of repetitions (based on R2-1712975 in R2#100). As per this paper, the issue of higher power consumption arises when large number of repetitions are potentially needed. In this case early termination is more useful, as it results in reduced UL transmissions (which consumes significantly more power compared to DL PDCCH monitoring – see power model in TR38.840). |
| Xiaomi | See comment | For Rel-15, it might have some benefit for DG, as for DG there is no such early termination mechanism, as concluded in RAN1 #104(R1-2102225) below:

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| --- |
| **Conclusion**For the sentence “The UE is not expected to be scheduled to transmit another PUSCH by DCI format 0\_0 or 0\_1 scrambled by C-RNTI or MCS-C-RNTI for a given HARQ process until after the end of the expected transmission of the last PUSCH for that HARQ process.” in TS 38.214 Clause 6.1,* The common understanding is that the DCI is expected to be received after the end of the last PUSCH.
 |

Please note that RAN1 has no consensus on whether the above conclusion also applicable for CG. But in section 6.1.2.3.1 in 38.214, CG repetition can be terminated by UL grant:

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| For any RV sequence, the repetitions shall be terminated after transmitting K repetitions, or at the last transmission occasion among the K repetitions within the period P, or from the starting symbol of the repetition that overlaps with a PUSCH with the same HARQ process scheduled by DCI format 0\_0 or 0\_1, whichever is reached first. |

For Rel-16, there are following two enhancements:1. UL cancellation indication introduced in Rel-16 URLLC: PUSCH repetitions collides with the indicated resources will be cancelled.
2. CG-DFI introduced in Rel-16 NR-U: If UE receives CG-DFI, CG repetitions will be terminated. CG-DFI is only used in shared spectrum, as in section 7.3.1.1.2 in 38.212 below:

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| DFI flag – 0 or 1 bit- 1 bit if the UE is configured to monitor DCI format 0\_1 with CRC scrambled by CS-RNTI and for operation in a cell with shared spectrum channel access. For a DCI format 0\_1 with CRC scrambled by CS-RNTI, the bit value of 0 indicates activating or releasing type 2 CG transmission and the bit value of 1 indicates CG-DFI. For a DCI format 0\_1 with CRC scrambled by C-RNTI/SP-CSI-RNTI/MCS-C-RNTI and for operation in a cell with shared spectrum channel access, the bit is reserved. |

Starting DRX RTT timer after the end of last repetition would disable the above two functions, i.e. it can not be configured together with them. Besides, from UE energy consumption point of view, CG-DFI has much potential in energy saving than delay DRX RTT timer. And the required change is much simpler, i.e. does not limit the use of CG-DFI to shared spectrum in 38.212. In short, for DG, starting DRX RTT timer after the end of last repetition has some benefit. For CG, extending CG-DFI to licensed spectrum is a much better solution. |

**Summary:**

If this proposal 1 is agreeable, to avoid NBC change, some backwards compatible modifications on TS 321/331/306 are needed. So, the following questions are whether the proposed text proposals in the appendix of [4] are agreeable or not.

**Q4: If companies agree with the Proposal 1, do you agree with the TP given in R2-2203484?**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Company** | **For 321 TP****Yes/****No/****Comments** | **For 331 TP****Yes/****No/****Comments** | **For 306 TP****Yes/****No/****Comments** | **Detailed comments** |
| Nokia | Yes | Yes | Yes |  |
| Ericsson | Y | N, see comment | Y | The text proposal for 331 need to be complemented with signalling of the new UE capability.  |
| Docomo | Yes | Comments | Yes | - New signalling should be a non-critical extension- Add UE cap signalling (as E/// comments)  |
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**Summary:**

## 3.4 Joint EHC and RoHC

In the RAN2#116 e-meeting, there was an offline discussion on joint EHC and RoHC for the case when EHC and RoHC are joint configured for a DRB and where “Type” field is not present (“Length” is used instead) in the Ethernet header. Unfortunately, no agreement was achieved. Hence, it might be beneficial to have common understandings in RAN2 to align the behavior in such a case.

In contribution [5], it is proposed that the most robust and clean solution would be always bypass RoHC for the Ethernet packet when “Type” field is not present for both EHC compressor and decompressor. The corresponding proposals are listed as follows,

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| **Proposal 1: RAN2 recommends both EHC compressor and decompressor to bypass RoHC for the Ethernet packet where “Type” field is not present, when joint EHC and RoHC is configured for a DRB.** **Proposal 2: To capture above into the chair notes.** |

**Q5: Do companies agree with the Proposal 1 and/or Proposal 2 given above?**

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| --- | --- | --- | --- |
| **Company** | **For P1****Yes/****No/****Comments** | **For P2****Yes/****No/****Comments** | **Detailed comments** |
| Samsung | Yes | Yes | We are fine to capture it in the chair notes or 38.323. |
| CATT | No | No | The case when Type field is absent is marginal. And it can be solved by NW implementation that gNB does not configure joint EHC and ROHC for such (rare) traffic types. |
| vivo | No | No | We are wondering whether the mentioned case really exists. In our understanding, as per TS 24.501, optional header compression of IP data and Ethernet data can only be applied to PDU sessions with IP PDU session type and Ethernet PDU session type. Further, the Ethernet PDU session type can only be supported only if EtherType is defined. In this sense, if the type is absent, we assume there would be no available Ethernet PDU session. Consequently, EHC protocol cannot be used. It means the mentioned case doesn’t exist at all. If we would like to resolve this issue, sending an LS to CT1 checking whether this case is valid or not is required. 6.2.2 PDU session typesThe following PDU Session types are supported:a) IPv4;b) IPv6;c) IPv4v6;d) Ethernet (EtherType as defined in IEEE Std 802.3 [31A]); ande) Unstructured. |
| Huawei, HiSilicon | Yes but | Yes but | We are also not sure if this case is rare, but if this is the case, we believe bypass ROHC would be the simpliest solution for implementation. Regarding the CT1 spec as indicated by vivo, we are not sure if d) Ethernet (EtherType as dfined in IEEE Std 802.3 [31A]) means EtherType field should be always present. As discussed in the previous e-meeting, there might be the case that there will be LLC/SNAP fields following the Ethernet header indicating the EtherType. But we are not sure if this is true for all Ethernet packets in the market.  |
| OPPO | No | No | We understand that in most cases Type field is present since Ethernet II is widely used in the market. On the other hand, if the Type/Length field is represented as Length, we think that the packet type can also be aware by further checking e.g. LLC/SNAP field, as we mentioned in the previous e-meeting. With this further information, the PDCP can know whether to bypass RoHC. Our understanding of the current text of "If a PDCP SDU including non-IP Ethernet packet is received from upper layers, the EHC compressor shall bypass the ROHC compressor" is that the EHC (de)compressor can identify the packet type no matter "Type" or "Length" field applies, although the details on how to identify the packet type are not captured. Thus, we do not expect anything more to be reflected in the spec or chair notes. |
| Qualcomm | See comment | See comment | We agree with the intention. However, we prefer a simpler solution: ROHC is allowed only for Ethernet II framing where the Ethernet Type is mandatory present. Otherwise, ROHC is NOT allowed, because Ethernet Type field may not always be present. |
| Intel | No | No | Agree with vivo. |
| ZTE | No | No | Agree with HW and CATT, we are not sure whether it is a rare case. |
| LG | No | No | Considering that the network would know whether the Type field for a QoS flow is absent or not, the network does not configure EHC and ROHC simultaneously to a DRB associated with the QoS flow if “Type” field is not present. |
| Ericsson | See comment | See comment | Tend to agree with above that this can be relied on network implementation. Would be good to hear views from the proponent companies on whether a network implementation can not solve it. |
| MediaTek | See comment | See comment | While we originally raised this issue; upon following up on Oppo’s response from the earlier round of email discussions, we now agree with Oppo that in the case where the 802.3 header only includes Length information, 802.2 LLC/SNAP would be present to aid with detection of ‘type’ information of subsequent headers.However, taking a conservative view here to avoid potential implementation issues, we are ok to agree to Proposal 1 or Qualcomm’s formulation. |
| Xiaomi | No | No | Agree with other companies that:1. network should avoid configuring both EHC and ROHC if type field is absent.
2. Ethernet PDU session may can not be established if type cannot be identified.
3. If type field is missing, there are other ways to identify the type, e.g. based on LLC/SNAP.
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**Summary:**

# 4 Conclusion

The contribution is summarized with proposals as follows,

*Phase 1:*

# 5 Reference

1. R2-2202110, Reply LS on UL skipping with LCH prioritization (R1-2112862; contact: vivo).
2. R2-2202524, Procedure level alignment of UL skipping, Apple.
3. R2-2202326, Correction on UL skipping with LCH Prioritization in Rel-16, vivo.
4. R2-2203484, Correction to DRX operation with bundling controlled in the DCI, Ericsson, Nokia, T-Mobile USA, Verizon, Docomo.
5. R2-2203131, Joint EHC and RoHC when Type is not present in Ethernet header, Huawei, HiSilicon.