3GPP TSG-RAN WG2 Meeting #114-e R2-210xxxx

e-Meeting, 19 May - 27 May 2021

**Agenda item: 6.1.3.1**

**Source: Apple**

**Title: Report of [AT114-e][017][NR16] MAC I - UL Skipping**

**WID/SID: NR\_IIOT-Core**

**Document for: Discussion and Decision**

# Introduction

This document aims to collect and report the results of the following email discussion.

 **[AT114-e][017][NR16] MAC I - UL Skipping (Apple)**

      Scope: Treat R2-2105780, R2-2104896, R2-2105852, R2-2105112, R2-2106442

      determine agreeable parts, for agreeable parts Work on CRs.

      Intended outcome: Report and Agreed CRs.

      Deadline: EOM, can do short post meeting email for CR(s).

UL skipping related

[R2-2105780](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105780.zip) UL Skipping Condition for LCH-basedPrioritization Samsung CR Rel-16 38.321 16.4.0 1109 - F NR\_IIOT-Core

[R2-2104896](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2104896.zip) Correction on UL skipping with lch-basedPrioritization CATT CR Rel-16 38.321 16.4.0 1098 - F NR\_IIOT-Core

[R2-2105852](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105852.zip) Correction to 38.321 on PUSCH Skipping coupled with intra-UE multiplexing ZTE, Sanechips CR Rel-16 38.321 16.4.0 1113 - F NR\_IIOT-Core

[R2-2105112](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105112.zip) UL skipping and intra-UE prioritization Apple discussion Rel-16 NR\_IIOT-Core

[R2-2106442](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2106442.zip) Discussion on whether to ignore an UL grant overlapped with UCI MediaTek Inc. discussion Rel-16

The email discussion is conducted in two phases:

* Phase 1: Collect companies’ comments, by Wednesday 2021-05-26 19:00 UTC
* Phase 2: Summary report and agreeable CR for review: TBD

# Participants

|  |  |
| --- | --- |
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# Discussion

## UL skipping and intra-UE prioritization

RAN2 discussed enhanced UL skipping during RAN2#113e and agreed on a working assumption [7] when *lch-basedPrioritization* is configured. According to the working assumption, which was confirmed in the RAN2#113bis-e meeting [8], *lch-basedPrioritization* takes precedence over UL skipping in Rel-16.

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| * [019] Working assumption: The MAC entity does not generate a MAC PDU for a deprioritized uplink grant even when its associated PUSCH is overlapping with PUCCH. * Confirm the WA that LCH based prio has higher priority than UL skipping still applies, and we expect that if there are issues, RAN1 will come-back. |

From rapporteur point of view we would like to note that RAN1 is still discussing whether the RAN2 working assumption can be confirmed, and what potential consequences this might imply for the RAN1 design. Assuming that RAN1 confirms the RAN2 working assumption without further changes or concerns, one option for RAN2 is to already prepare a CR. However, there is a possibility that RAN1#105e may postpone the confirmation of the RAN2 working assumption.

**Question 1) Do you agree to capture the RAN2 working assumption in a CR at this point in time?** This could be treated under the assumption that RAN1 confirms the RAN2 WA without additional concerns. Please answer ‘Yes’ if you think that RAN2 can already prepare a CR, and ‘No’ if you think RAN2 should rather wait for RAN1 to confirm the RAN2 working assumption.

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| **Company** | **Q1**  **(Yes/No)** | **Comments** |
| ZTE | No | According to the discussion outcome from RAN1, they postpone the confirmation on whether the LCH based prioritization procedure have a higher priority than the UL skipping check.  For avoiding the possible redundant change for MAC spec, we prefer to postpone the CR discussion until RAN1 have a clear conclusion on this issue. |
| LG | Yes |  |
| Xiaomi | No | It seems ok not to rush to a RAN2 CR in this RAN2 meeting. |
| Apple | Yes (tentative) | The intermediate summary from RAN1 (in [105-e-NR-L1enh-URLLC-04]) seems to say the RAN2 WA is confirmed by a majority at least in general, but it is not finalized yet. We think that we could prepare a CR in this case. However, if there is a different final outcome in RAN1 then RAN2 should not agree a CR at this point. |
| Nokia | No | Although we agree with the intention, procedure-wise it is still better to wait until it is confirmed, so we can avoid potentially redundant work. |
| CATT |  | This question is what we discuss in offline [016]. We don’t think it is related to the CRs in 5780, 4896, 5852. See below. |
| Samsung | Yes | We are fine to wait. But we do not see it is likely to be reverted. For implementation, it would be better to implement for 16.5.0 |
| OPPO | Yes, but | It is okay to capture what we have decided. If RAN1 has some concern or finds some issues, they can require RAN2’s modification accordingly. But, we are also fine to postpone until RAN1 officially confirms. |
| MediaTek | No | Agree with Nokia that procedurally, it is better to wait for R1 to confirm our assumption before undertaking a CR. |
| Vivo | No | We prefer to wait for further RAN1 input. |
| Lenovo | No | Agree that we should wait until RAN1 confirms our assumption |
| III | No | Agree with wait for RAN1 confirms our assumption. |
| Intel | No | Although we support the RAN2 working assumption, we prefer that RAN2 wait for RAN1’s progress since the confirmation of RAN2 WA in RAN1 might be postponed (as from 3rd round of RAN1 email discussion “[105-e-NR-L1enh-URLLC-04]”). |
| Huawei, HiSilicon | No | We can wait for RAN1 progressing on this. |
| Qualcomm | No | We prefer to wait for RAN1’s decision. |
| Ericsson | No | Wait for the confirmation of the WA. There is no rush to capture it in the MAC spec, since the feature won’t be implementable without RAN1 confirmation and potential PHY spec changes. |

***Summary of Question 1:***

*16 companies provided input to this question. 11 companies think that RAN2 should not proceed with a CR at this point in time, e.g., to avoid a potentially redundant change in case RAN1 concludes with additional assumptions. 4 companies think that RAN2 gan go ahead and already prepare a CR. However, all but one are also fine to wait. One company thinks that the decision should be taken together with the outcome of the related email discussion [016].*

*Out of all 16 companies that have responded to Q1, 14 companies are OK to wait for RAN1 before making a final decision on a change to the MAC specification. Therefore RAN2 as well may go with the majority view and postpone the finalization of the changes to the next RAN2 meeting.*

**Proposal 1: RAN2 does not agree a CR at this time, we can wait for RAN1’s conclusion.**

## Solutions for UL skipping with LCH based prioritization

[R2-2105780](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105780.zip) UL Skipping Condition for LCH-basedPrioritization Samsung CR Rel-16 38.321 16.4.0 1109 - F NR\_IIOT-Core

[R2-2104896](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2104896.zip) Correction on UL skipping with lch-basedPrioritization CATT CR Rel-16 38.321 16.4.0 1098 - F NR\_IIOT-Core

[R2-2105852](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105852.zip) Correction to 38.321 on PUSCH Skipping coupled with intra-UE multiplexing ZTE, Sanechips CR Rel-16 38.321 16.4.0 1113 - F NR\_IIOT-Core

[R2-2105112](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105112.zip) UL skipping and intra-UE prioritization Apple discussion Rel-16 NR\_IIOT-Core

The contributions in [2][3] [4] propose a change to the MAC specification to enable the RAN2 working assumption on enhanced UL skipping with lch-basedPrioritization in the specification.

**Option 1 (1A: R2-2105780/Samsung [2], 1B: R2-2104896/CATT [3]): It is proposed to remove the restriction when lch-basedPrioritization is not configured from the set of conditions for Rel-16 UL skipping.**

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| 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; and  1> if there is no UCI to be multiplexed on this PUSCH transmission as specified in TS 38.213 [6]; and  1> if there is no aperiodic CSI requested for this PUSCH transmission as specified in TS 38.212 [9]; and  1> if the MAC PDU includes zero MAC SDUs; and  1> 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:  2> 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; and  1> if there is no aperiodic CSI requested for this PUSCH transmission as specified in TS 38.212 [9]; and  1> if the MAC PDU includes zero MAC SDUs; and  1> 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:  2> not generate a MAC PDU for the HARQ entity. |

**Option 2 (R2-2105852, ZTE): The CR intends to capture the RAN2 WA for the case when MAC is configured with lch-basedPrioritization while Rel-16 PUSCH skipping is configured in the following way.**

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| 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; and  1> if the MAC entity is not configured with *lch-basedPrioritization*, or if the MAC entity is configured with *lch-basedPrioritization* and the UL grant is prioritized; and  1> if there is no UCI to be multiplexed on this PUSCH transmission as specified in TS 38.213 [6]; and  1> if there is no aperiodic CSI requested for this PUSCH transmission as specified in TS 38.212 [9]; and  1> if the MAC PDU includes zero MAC SDUs; and  1> 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:  2> 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; and  1> if there is no aperiodic CSI requested for this PUSCH transmission as specified in TS 38.212 [9]; and  1> if the MAC PDU includes zero MAC SDUs; and  1> 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:  2> not generate a MAC PDU for the HARQ entity. |

**Question 2: If the answer to Q1 is ‘Yes’, which of the options do companies agree/prefer to specify?** For Option 1, please also indicate whether you prefer the CR in R2-2105780 (option 1A) or the CR in R2-2104896 (option 1B) as a baseline.Note that the exact CR can be further discussed after we agree the direction of change.

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| **Company** | **Option**  **(1A / 1B / 2)**  **Agree as is; Agree with changes; Disagree** | **Comments** |
| ZTE | (Proponent of Option 2) | Just a short comment, in our understanding, the main difference between option 1 and option 2 is that option 1 does not reflect the WA in RAN2 (i.e LCH based prioritization procedure have a higher priority than the UL skipping check) while the Option 2 reflect this WA explicitly.  Anyway, since the WA confirmation is postponed in RAN1, we think the CR discussion can be pending until there is outcome from RAN1.  [Apple] I guess Option 1B is a mixup/typo and it should read Option 2?  [ZTE]：Exactly, thanks for pointing out. |
| LG | Option 1 | Failed to find any difference between option 1A and 1B. Thus, either one is fine to be used as a baseline.  In option 2, it further states in the condition whether the uplink grant is prioritized one, which seesm not necessary because as in S5.4.2.1, the MAC will tray to obtain the MAC PDU from M&A entity only for the prioritized uplink grant. |
| Apple | Option 1A | We would like to confirm the RAN2 WA as a baseline. In our understanding, LCH-based prioritization (in 5.4.1) happens before LCP (5.4.3.1.3), therefore, removing the line as proposed in both 1A and 1B essentially has the effect that LCH-based prioritization takes precedence over Rel-16 enhanced UL skipping. The same behavior actually applies for Rel-15 UL skipping already. |
| Nokia | Option 1A/1B | Not sure what is the difference between 1A and 1B.  Agree with LG, this part of specification is written under the clause 5.4.3, which deals with MAC’s behavior when a MAC PDU is to be generated by M&A, so it has to be a priortiized grant anyway (when LCH-based prioritization is configured). Therefore Option 2 is not needed. |
| CATT (option 1/B proponent) | Agree 1A or 1B | This CR is independent of the WA and should be agreed.  It is clear that when *lch-basedPrioritization* is configured, an UL grant not overlapping with any other grant or SR will be de-facto prioritized by the lch-based prioritization procedure, but it could be empty and then the R16 PUSCH skipping procedure should apply equally as when when *lch-basedPrioritization* is not configured. And so, if there would be UCI to be multiplexed on the associated PUSCH the “MAC-delivering-an-empty-PDU” behavior should also apply.  1/A/1B are identical so we are fine with either CR. |
| Samsung | Option 1 | We see no difference between 1A and 1B. They are proposing exactly the same change.  Option 2 has the same UE behaviour as 1A/1B. This means that we do not need this condition at all. |
| OPPO | Option 1A/1B | We also think there is no difference between 1A and 1B.  Regarding Option 2, we think there is no need to mention whether the uplink grant is prioritized in the case with LCH-based prioritization, since the MAC will not perform UL skipping check unless the grant is a prioritized one. |
| MediaTek | Option 1A/B | As there is no difference between 1A and 1B, we are ok with this approach. Effectively it is implicit that LCH prioritisation takes place first, as we only hit the UL skipping check for a prioritised grant. |
| Lenovo | Option 1A/1B | 1A and A1B seems to propose same change. |
| III | Option 1A/1B | We cannot find any difference between option 1A and 1B. |
| Intel | Option 1 | We don’t see any difference between option 1A and 1B as the proposed changes are the same. The only differences are the CR cover sheet.  We also think Option 1 (either 1A or 1B) is sufficient since clause 5.4.3.1.3 is about MAC PDU generation after the uplink is prioritized. |
| Huawei, HiSilicon | Option 1A | Prefer the simpler change. |
| Qualcomm | Option 1A/B | If companies agree to have a draft CR before RAN1’s conclusion, either Option 1Aor Option 1B is fine with us (The TPs in the two CRs look exactly the same) |

***Summary of Question 2:***

*13 companies provided input to this question. Option 1A is supported by 12 companies. Option 1B is supported by 10 companies. Option 2 is supported by the proponent company. All companies except the proponent company of Option 2 prefer the change in Option 1.*

*The CRs in Option 1A (R2-2105780) and 1B (R2-2104896) are the same except for the cover sheet. According to companies’ views in question 1, RAN2 does not necessarily need not attempt to agree a CR, but conclude once feedback from RAN1 is available. Nevertheless RAN2 can already capture the MAC procedure change in R2-2105780, R2-2104896 as a baseline to enable lch-basedPrioritization when enhanced UL skipping is configured.*

**Proposal 2: RAN2 to discuss the status of R2-2105780 and R2-2104896. R2-2105852 is not pursued.**

The contribution in [5] proposes a few additional options to enable lch-basedPrioritization with enhanced UL skipping in Rel-16. Alternative 1 is similar to Option 1A and 1B proposed by [2][3][4] in question 2 above, alternatives 2 and 3 can be considered as additional enhancements (presumably even on top).

* **Alternative 1:** LCH-based prioritization takes precedence over UL skipping (similar to [2][3][4]).
* **Alternative 2:** The UL grant mapped to a PUSCH-with-UCI for which LCH data is available is selected as prioritized grant.
* **Alternative 3:** Adopt a scheme to increase the LCH priority of UL grants for PUSCH with multiplexed UCI according to pre-defined rules, so that a PUSCH-with-UCI gets a higher probability to become the prioritized grant.

**Question 3: Do companies wish to consolidate additional changes?** If yes, please indicate which of the alternatives you prefer. Note that the exact solution can be further discussed after we agree the direction of change.

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| **Company** | **Alternative**  **(A1/A2/A3)** | **Comments** |
| ZTE | No additional enhancement | We are not willing to introduce additional enhancement for this issue at this very late stage of Rel-16 since the current priority handling procedure is pretty much complex.... |
| LG | No additional enhancement | We see no big motivation of having some flexibility to promote or not promote the UCI-multiplexed PUSCH, hence, A3 is not preferred.  Alternative 2 may bring undesirable/complex issue to URLLC data. For example, higher priority logical channel data may be delayed due to UCI-multiplexed PUSCH. In our view, it is sufficient not to skip UCI-multiplexed PUSCH if it has change to be transmitted and too late to have another enhancement for it.  Alternative 1 is really not clear what alterantive it refers to and how it works. |
| Apple | A3 | The case where UCI is to be multiplexed in a PUSCH requires a balance between a) ‘always generating a MAC PDU’ (i.e., no skipping, no matter what’s the LCH priority and regardless of whether or not there is data available) and b) ‘always giving precedence to LCH-based prioritization’ (which implies that the PUSCH-with-UCI can get deprioritized). Therefore A3 is our preference, followed by A2. Both changes are relatively straight-forward, however, if companies think this is too much for Rel-16 we are also fine to accept A1, which we understand is the current RAN2 WA (dealt with in question 2). |
| Nokia | No additional enhancement | If our understanding is correct, A1 is already what we have agreed as the working assumption.  A2 and A3 look like enhancements that dilute the purpose of LCH-based prioritization, which has not been thoroughly discussed and hence not acceptable. In particular, PHY should do UCI multiplexing based on which grant is prioritized in MAC, but A2 sounds like the other way around. A3 is complicated without clear motivation, LCH priority is set to reflect QoS requirement, why it should be affected by UCI ? |
| CATT | No additional enhancement | We agreed at this meeting that “MAC does not use knowledge of UCI multiplexing when MAC executes LCH based prioritization and deciding when to transmit SR (i.e. in the context of the cases listed in R2-2105781)”.  So only A1 is possible, which is discussed in offline [016]. |
| Samsung | No additional enhancement | Didn’t RAN2 already agree not to prioritized UCI-multiplexed PUSCH in LCH-based prioritization? |
| OPPO | No additional enhancement | Agree with CATT, RAN2 has agreed the UCI multiplexing is not considered in LCH-based prioritization. Also, RAN2 agrees that LCH-based prioritization has higher priority than UL skipping check. Doesn’t the additional enhancement look a bit against to our agreement? |
| MediaTek | No additional enhancement |  |
| vivo | A1 | We prefer to stick to the RAN2 WA (i.e. A1) and not to revert the WA. For the other two alternatives, it seems they contradict A1. In this sense, unless A1 cannot be confirmed by RAN1, otherwise, A2 and A3 seem not practical. |
| Lenovo | No additional enhancement |  |
| III | No additional enhancement |  |
| Intel | No additional enhancements | Considering Rel-16 has been frozen for sometime, we prefer not to consider enhancements in alternative 2 and 3. Alternative 1 is already covered by previous RAN2 WA. |
| Huawei, HiSilicon | No additional enhancement |  |
| Qualcomm | A1 only; no additional enhancement | Both A2 and A3 would mandate UE implementation to have MAC check with PHY for potential UCI multiplexing before performing LCH-based prioritization, which RAN2 already agreed not to support during online discussion. |
| Ericsson | No additional enhancement |  |

***Summary of Question 3:***

*15 companies provided input to this question. A majority of companies (all but the proponent of A3) prefers no additional enhancements in Rel-16 on top of the current RAN2 working assumption. 6 companies indicated that they are OK with Alternative 1. Since Alternative 1 just refers the change discussed in question 2, no further enhancement is agreed when both lch-basedPrioritization and enhanced UL skipping are configured in Rel-16. It is proposed to note the discussion paper in R2-2105112.*

*When both lch-basedPrioritization and enhanced UL skipping are configured in Rel-16, enhancements other than what is needed to enable the RAN2 working assumption are not considered.*

**Proposal 3: R2-2105112 is noted.**

## Discussion on whether to ignore an UL grant overlapped with UCI

The contribution in [6] raises the question whether RAN2 should revisit the principle to flush the HARQ buffer if the UE skips an UL transmission given the recent changes in RAN1 for R16 UL skipping.

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| 5.4.2 HARQ operation  5.4.2.1 HARQ Entity  For each uplink grant, the HARQ entity shall:  1> identify the HARQ process associated with this grant, and for each identified HARQ process:  2> if the received grant was not addressed to a Temporary C-RNTI on PDCCH, and the NDI provided in the associated HARQ information has been toggled compared to the value in the previous transmission of this TB of this HARQ process; or  …  2> if the uplink grant is part of a bundle of the configured uplink grant, and may be used for initial transmission according to clause 6.1.2.3 of TS 38.214 [7], and if no MAC PDU has been obtained for this bundle:  …  3> if a MAC PDU to transmit has been obtained:  4> …  3> else:  4> flush the HARQ buffer of the identified HARQ process.  2> else (i.e. retransmission):  3> if the uplink grant received on PDCCH was addressed to CS-RNTI and if the HARQ buffer of the identified process is empty; or  3> if the uplink grant is part of a bundle and if no MAC PDU has been obtained for this bundle; or  3> if the uplink grant is part of a bundle of the configured uplink grant, and the PUSCH duration of the uplink grant overlaps with a PUSCH duration of another uplink grant received on the PDCCH or an uplink grant received in a Random Access Response (i.e. MAC RAR or fallbackRAR) or an uplink grant determined as specified in clause 5.1.2a for MSGA payload for this Serving Cell; or:  3> if the MAC entity is configured with *lch-basedPrioritization* and this uplink grant is not a prioritized uplink grant:  4> ignore the uplink grant. // whether UE should skip this uplink grant in case the PUSCH for retransmissin is overlapped with UCI?  3> else:  4> … |

The scenario would typically happen if, for example, the UE did not have data available at initial transmission while there was also no overlapping UCI. As a result, the initial transmission gets skipped as part of the normal UL skipping procedure and MAC does not create a MAC PDU for the UL grant. Per the current procedure, MAC flushes the HARQ buffer in this case.

Now if the UE would receive a DCI requesting a retransmission for such earlier HARQ process (or more generally any retransmission grant where MAC did not create a MAC PDU at InitialTx), MAC basically ignores the retransmission grant per the current procedure.

Then the question is, if PHY had a UCI to transmit at the time of such a ReTx, is MAC supposed to create an empty MAC PDU (just for the sake of UCI) in response to the retransmission grant? If the scenario is valid then the rapporteur thinks that RAN2 may end up with change somewhat similar to what might be required for TB repetition as well, where, depending on the solution that RAN1 will select, MAC could be required to adjust the creation time of a MAC PDU (currently at InitialTx only).

**Question 4: Do you think the scenario is valid in the sense that MAC should create a MAC PDU when a retransmission grant overlaps with UCI and the initial transmission was skipped earlier?** If you think the scenario is valid, please indicate the expected UE behavior to handle a retransmission uplink grant overlapping with UCI.

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| **Company** | **Q4**  **(Yes/No)** | **Comments** |
| ZTE | No, but | We think the current spec is clear that the UL grant for retransmission would be ignored.  With the below reason, we think MAC should not create a MAC PDU for retransmission:  1: The case is much rare case, if NW does not receive one UL transmission and the UL skipping is configured before hand, NW won’t schedule any retransmission for this HARQ process ID since the power and front loaded DMRS is not detected.  2: Assuming that the MAC PDU is generated(i.e may include only padding) for the retransmission grant, it may cause the logic confusion on the retransmission or new transmission, does it really belong to retransmission when a new MAC PDU is generated for a retransmission？ |
| LG | No | We tend to agree with ZTE that generation of MAC PDU for the retransmission grant of which the initial transmission is skipped may confuse the general logic of initial/re-tx. For example, the MAC needs to obtain a new MAC PDU for retransmission grant or the MAC needs to treat a grant as a new transmission grant even when NDI is not togged if UCI is to be transmitted.  In addition, it may come with another question why we don’t use that UL grant for transmitting any other data rather than ignoring it. For instance, why don’t we use it for transmitting higher priority data?  Considering above, we prefer to keep the current principle as it is, i.e., to ignore retransmission grant if it is for the skipped HARQ transmission. |
| Xiaomi | No | We think that the case that the gNB sends a retransmission DCI for an skipped uplink grant is rare in reality, as the gNB is able to detect the grant skipped by the UE, e.g. via the power detection of PUSCH. |
| Apple | No | We think RAN1 considered the existing MAC PDU generation sequence as a baseline for UL skipping so far. Agree with ZTE that the scenario seems a corner case – if the InitialTx did not happen the gNB should detect that nothing was received in uplink for the PUSCH and typically not generate a retransmission grant. |
| Nokia | No | From gNB perspective, if the earlier initial transmission is already skipped, the gNB can already know that nothing else will be transmitted in this bundle (because obviously the initial transmission happens earlier than retransmission). Hence there is no extra burden of blind decoding. |
| CATT | No | First, it is our understanding that [5] actually discusses the case of a repetition grant within a bundle rather than a gNB-scheduled dynamic retransmission grant for this bundle. Indeed, it would not make sense for NW to schedule a retransmission grant before it has received the whole bundle for DTX detection.  That being clarified, we agree with MediaTek that the current MAC behaviour is to not provide a PDU for a repetition in a CG bundle if the initial grant was skipped. But given this behaviour is clear and known by the NW, we think there is no ambiguity and NW either avoids this corner case, or it performs the blind detection on the repetition grant overlapping with UCI as part of its DTX detection algorithm. In other words, no change is needed. |
| Samsung | No |  |
| OPPO | No | Agree with the above companies, it seems a corner case and there is no issue for the gNB blind detection. |
| MediaTek | To be checked with R1 | We have raised this issue to have clear UE behaviour. R1 indicated in their LS to R2 that if a PUSCH occasion overlaps with UCI, the UE should multiplex the UCI with the PUSCH. This branch in our spec contradicts expected R1 behaviour, so it is worthwhile discussing what the UE is expected to do.  The arguments that this is a corner case is irrelevant given that we have UE behaviour defined for this supposedly corner case. We wouldn’t have defined UE behaviour, if we didn’t think this would occur.  We note that R1 are discussing expected UE behaviour in case of repetitions in email thread [105-e-NR-7.1CRs-11]. We think that it would be best to have consistent behaviour for repetitions and CG retransmission grants in this branch of the MAC spec. From that perspective, we are ok to wait for R1 to conclude on UE behaviour in case of repetitions and apply the same behaviour for CG retransmission grants. |
| vivo | No | In this case where the NW is not sure whether UL skipping is performed or initial transmission cannot be detected due to poor radio condition, we think the smart NW should avoid scheduling retransmission that is overlapped with UCI. In this sense, no enhancement is needed for UE. |
| Lenovo | No |  |
| III | No |  |
| Intel | No | Our understanding is that according to current specification, uplink grant for retransmission is ignored if MAC PDU is not obtained for the initial transmission. There is no need to consider enhancements in the late stage of Rel-16. |
| Huawei, HiSilicon | No | This would be corner case mixed with bundling operation. If MAC skip the retrasmission with UCI multiplexing, PHY can still handle it, i.e., when MAC doesn't deliver PDU when it should (as there is UCI to be multiplexed), PHY shall be able to send UCI in PUCCH. PHY shall not prepare UCI multiplexing before MAC and then fails, when there is no PDU from MAC. |
| Qualcomm | See comment | If UE does receives a grant for retransmission after UE skips the first transmission (although we are not sure how likely it may happen in real networks), then we think UE should generate a MAC PDU if this retransmission grant overlaps with a UCI.  We prefer to postpone discussion on this issue until RAN1 make more progress on the case of configured grant with repetition, so that we can have consistent UE behaviors. |
| Ericsson | Postpone | Ericsson agrees that the current spec reads that the UL retransmission grant for an initial CG transmission is ignored and so this grant would be skipped even if it has UCI to-be-mutiplexed on it. There is no blind decoding issue at gNB, but merely an error case since the gNB mis-detects noise as an UL transmission attempt from the UE. How frequently this happens would depend on the implementation but RAN2 can assume that it is unlikely for UEs in good SINR conditions. Ericsson also agrees with the comment by ZTE/LG that it is not clear how to model it in the MAC, if MAC is requested to transmit a padding PDU for retransmission. It also messed up the soft-buffer handling at the gNB, since the gNB would keep the soft-buffer from the initial transmission which is a noise.  The answer “no” may not be the intention from the RAN1 LS as pointed out by MediaTek. If RAN2 agrees according to the majority view, there is a need to indicate to RAN1. This case is also different from what is under discussion in RAN1 for the case of configured grant with repeititon. Ericsson supports confirmation/clarification for a deterministic UE behaviour but not sure the need to have a consistent UE behaviour for the two cases. |

***Summary of Question 4:***

*Out of 16 companies that provided input to this question, 13 companies indicated the scenario does not justify that MAC creates an empty MAC PDU (just for the sake of UCI) in response to a retransmission grant. 9 companies also pointed out that the scenario is expected to be a rare case. However, a majority of companies agreed that the current HARQ operation implies that the retransmission grant is ignored when the initial transmission is skipped and the network sends a retransmission grant. Two companies prefer to postpone the issue until RAN1 makes more progresss on UL skipping with TB repetition, and 2 companies would like to confirm the intended UL skipping behavior with RAN1.*

*Along with the input received in question 5 and to have a complete picture of UL skipping requirements, it is proposed to first wait for RAN1 input on TB repetitions and UL skipping before discussing this case further or even asking RAN1 for clarification.*

**Proposal 4: R2-2106442 is postponed.**

From rapporteur point of view RAN2 may as well consider discussing a potential solution after RAN1 concluded their current discussion of TB repetitions with Rel-16 UL skipping, because the options RAN1 has in mind may create a requirement for RAN2 to change the specification for the HARQ retransmission case anyway.

**Question 5: Do companies agree to wait until RAN1 concludes on Rel-16 UL skipping with TB repetitions?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Q5**  **(Yes/No)** | **Comments** |
| ZTE | Maybe.. | We cannot consider about the solution until the LS related this issue is received. |
| LG | Yes |  |
| Xiaomi | Yes |  |
| Apple | Yes | A potential change to the sequence of MAC PDU generation, if needed at all, could be discussed after RAN1 concludes on TB repetitions with enhanced UL skipping in R16. |
| Nokia | Yes |  |
| CATT | Yes | We can wait for RAN1 |
| Samsung | Yes | But no proposal is needed for now. |
| OPPO | Yes | Wait for RAN1. |
| MediaTek | Yes | We can wait for R1. We prefer to have consistent UE behaviour in the specifications. |
| vivo | Yes | We would like to point out that the corresponding LS is supposed to be available in the next RAN2 meeting. So we can wait for now. |
| Lenovo | Yes |  |
| III | Yes |  |
| Intel | Yes | We can wait for RAN1 conclusion and then see whether there are any RAN2 impacts from RAN1 agreements. |
| Huawei, HiSilicon | Yes | We shall wait for RAN1 |
| Qualcomm | Yes |  |
| Ericsson | Yes |  |

***Summary of Question 5:***

*All companies agree that RAN2 should wait for RAN1’s conclusions on simultaneous configuration of enhanced UL skipping and TB repetitions before reassessing the MAC PDU generation sequence in the context of R2-2106442.*

**Proposal 5: Wait for RAN1 to conclude on the intended operation of TB repetitions with enhanced UL skipping in Rel-16.**

# Conclusions

**Summary 1:** RAN2 may as well go with the majority view and postpone the finalization of changes to the next RAN2 meeting.

**Proposal 1: RAN2 does not agree a CR at this time, we can wait for RAN1’s conclusion.**

**Summary 2:** RAN2 can already capture the MAC procedure change in R2-2105780, R2-2104896 as a baseline to enable lch-basedPrioritization when enhanced UL skipping is configured.

**Proposal 2: RAN2 to discuss the status of R2-2105780 and R2-2104896. R2-2105852 is not pursued.**

**Summary 3:** Since Alternative 1 just refers the change discussed in question 2, no further enhancement is agreed when both lch-basedPrioritization and enhanced UL skipping are configured in Rel-16.

**Proposal 3: R2-2105112 is noted.**

**Summary 4:** Along with the input received in question 5 and to have a complete picture of UL skipping requirements, it is proposed to first wait for RAN1 input on TB repetitions and UL skipping before discussing this case further or even asking RAN1 for clarification.

**Proposal 4: R2-2106442 is postponed.**

**Summary 5:** All companies agree that RAN2 should wait for RAN1’s conclusions on simultaneous configuration of enhanced UL skipping and TB repetitions before reassessing the MAC PDU generation sequence in the context of R2-2106442.

**Proposal 5: Wait for RAN1 to conclude on the intended operation of TB repetitions with enhanced UL skipping in Rel-16.**

# References

[1] RAN2#114e, Chairman’s Notes

[2] [R2-2105780](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105780.zip), UL Skipping Condition for LCH-basedPrioritization, Samsung

[3] [R2-2104896](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2104896.zip), Correction on UL skipping with lch-basedPrioritization, CATT

[4] [R2-2105852](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105852.zip), Correction to 38.321 on PUSCH Skipping coupled with intra-UE multiplexing, ZTE, Sanechips

[5] [R2-2105112](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2105112.zip), UL skipping and intra-UE prioritization, Apple

[6] [R2-2106442](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_114-e\Docs\R2-2106442.zip), Discussion on whether to ignore an UL grant overlapped with UCI, MediaTek Inc.

[7] Draft\_R2-113-e\_Meeting\_Report\_v1

[8] Draft\_R2-113bis-e\_Meeting\_Report\_v2