3GPP TSG RAN WG1 #104-e R1-210xxxx

**e-Meeting, January 25th – February 5th, 2021**

**Title: [Draft] Reply LS on overlapped data and SR are of equal L1 priority**

**Release: Rel-16**

**Work Item: NR\_IIOT-Core**

**Source:** vivo [To be RAN1]

**To:** RAN2

**Cc:**

**Attachments:**

**Contact Person:**

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**1. Overall Description:**

RAN1 would like to thank RAN2 for the LS R1-2100026 (R2-2011124) on overlapped data and SR are of equal L1 priority.

RAN1 had discussed the following cases when LCH based prioritization is configured. The examples are provided in the figures for each case.

* Case 1: only SR overlaps with PUSCH of equal L1 priority
* Case 2: other UCI(s) i.e., HARQ-ACK/CSI overlap with SR of equal L1 priority and the SR overlaps with the PUSCH of equal L1 priority
	+ Case 2-1: the final PUCCH resource after UCI multiplexing among different PUCCHs carrying HARQ-ACK/CSI and SR does not overlap with the PUSCH
	+ Case 2-2: the final PUCCH resource after UCI multiplexing among different PUCCHs carrying HARQ-ACK/CSI and SR overlaps with the PUSCH
* Case 3: other UCI(s) i.e., HARQ-ACK/CSI overlap with a PUSCH of equal L1 priority, SR overlaps with the PUSCH of equal L1 priority, but other UCI(s) do not overlap with the SR



Case 1: only SR overlaps with PUSCH of equal L1 priority



Case 2-1: the final PUCCH resource after UCI multiplexing does not overlap with PUSCH



Case 2-2: the final PUCCH resource after UCI multiplexing overlaps with PUSCH



Case 3: other UCI(s) overlap with a PUSCH, SR overlaps with the PUSCH, SR does not overlap with other UCI(s)

For case 1 of only SR overlaps with PUSCH of equal L1 priority, RAN1 think the intended UE behaviour as described in the LS can be supported if the CR [R1-2009687](file:///E%3A%5Claptop%5CRAN_1_meeting%5C103%5CDocs%5CR1-2009687.zip) is implemented into the specification. But some companies in RAN1 think it may have impacts on the PHY processing timeline.

For case 2-1 of resource overlapping between PUSCH and SR of equal L1 priority, if there are other UCI(s) i.e., HARQ-ACK/CSI of the equal L1 priority overlapping with SR, and the final PUCCH resource after UCI multiplexing among different PUCCHs does not overlap with the PUSCH, RAN1 has the following two understandings:

* Undersatnding 1: MAC is not aware of the UCI multiplexing in PHY, MAC does not know whether the final PUCCH overlaps with the PUSCH or not, MAC only knows configured PUCCH resource for SR. Therefore, MAC can decide to deliver SR or PUSCH.
* Undersatnding 2: MAC is aware of the UCI multiplexing in PHY based on UL skipping agreement (as in LS R1-2009772). If MAC is aware that the final PUCCH resource does not overlap with the PUSCH, then for case 2-1, MAC can send both SR and PUSCH to PHY.

For other cases, i.e. case 2-2 and case 3, RAN1 has the following two different understandings:

* Understanding 1: the UL skipping-related check is prioritized over the LCH based prioritization check in MAC. Therefore, if the PUSCH in the LS is expected to have UCI multiplexing, MAC does not prioritize SR over PUSCH, and send a MAC PDU to PUSCH instead.
* Understanding 2: LCH based prioritization check is prioritized over the UL skipping-related check in MAC. Therefore, the SR in the LS is prioritized in MAC and is delivered and MAC shall not deliver the MAC PDU for the PUSCH.

**2. Actions:**

**To RAN2 group**

**ACTION:**

RAN1 respectfully ask RAN2 to provide their views on which understanding (understanding 1 or 2 above) is the intended MAC layer behavior or to provide an alternate understanding, for above case 2-1, case 2-2 and case 3.

**3. Date of Next RAN1 Meetings:**

TSG-RAN WG1 Meeting #104bis-e 12th April – 20th April 2021 E-meeting.

TSG-RAN WG1 Meeting #105-e 19th May – 27th May 2021 E-meeting.

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| Company | Comments  |
| Hw/HiSi | RAN1 would like to thank RAN2 for the LS R1-2100026 (R2-2011124) on overlapped data and SR of equal L1 priority.For case 1, we think that the wording proposed by QC in their earlier comment is slightly better::For case 1 of only SR overlaps with PUSCH of equal L1 priority, from RAN1 point of view the intended UE behaviour as described in the LS can be supported if the CR [R1-2009687](file:///E%3A%5Claptop%5CRAN_1_meeting%5C103%5CDocs%5CR1-2009687.zip) is implemented into the specification. RAN1 will continue the discussion on any potential impact on the PHY layer including any change that might be needed for UE’s processing timelineFor case 2-1, the new wording changes the meaning of Understanding 1 and Understanding 2 that have been ddiscussed previously and that are already supported by so many companies.In the previous wording, RAN1 displays two understandings and asks RAN2 for feedback which of them is correct. The two understandings in the previous wording are mutual exclusive. This is not the case in the new revised wording. The revised wording seems to imply which understanding is correct depends on whether Rel-16 UL skipping is enabled or not. From spec point of view it seems that the two understandings can exists together. It changes the meaning what has been discussed previously and would require a whole new round of discussion. We prefer to keep the original wording that companies have discussed and support.For case 2-1 of resource overlapping between PUSCH and SR of equal L1 priority, if there are other UCI(s) i.e., HARQ-ACK/CSI of the equal L1 priority overlapping with SR, and the final PUCCH resource after UCI multiplexing among different PUCCHs does not overlap with the PUSCH, RAN1 has the following understandings: * Understanding 1: MAC is not aware of the UCI multiplexing in PHY, MAC does not know whether the final PUCCH overlaps with the PUSCH or not, MAC only knows initial PUCCH resource for SR. Therefore, MAC can decide to deliver SR or PUSCH.  Understanding 2: MAC is aware of the UCI multiplexing in PHY based on UL skipping agreement in R1-2009772. If MAC is aware that the final PUCCH resource does not overlap with the PUSCH, then for case 2-1, MAC can send both SR and PUSCH to PHY.

For other cases, i.e. case 2-2 and case 3 2, there might also be a time-line issue, because the PHY processing could be dependent on MAC decisions. For consistency and to avoid ambiguity, we would like to include the same sentence as for case 1 also for these cases:For other cases, i.e. case 2-2 and case 3, RAN1 has the following two different understandings:* Understanding 1: the UL skipping-related check is prioritized over the LCH based prioritization check in MAC. Therefore, if the PUSCH in the LS is expected to have UCI multiplexing, MAC does not prioritize SR over PUSCH, and send a MAC PDU to PUSCH instead.
* Understanding 2: LCH based prioritization check is prioritized over the UL skipping-related check in MAC. Therefore, the SR in the LS is prioritized in MAC and is delivered and MAC shall not deliver the MAC PDU for the PUSCH.

For other cases, i.e. case 2-2 and case 3, the PHY operation is dependent on a MAC decision, RAN1 will continue the discussion on any potential impact on the PHY including any change that might be needed for UE’s processing time line.For the action part, similar to our comment above we prefer the orginal wording or the suggestion earlier made by QC:RAN1 respectfully ask RAN2 to provide their views on which understanding is the correct interpretation of the MAC specification, or to provide an alternate understanding, for above case 2-1, case 2-2 and case 3 |
| Nokia, NSB | Case 2-1: Similar as HW/HiSi we are a bit wondering why the description for case 2-1 was now changed, which also we with reflects a different meaning than what was done in Third round #2 below. Also we prefer the original wording (cannot agree to the modified text for case 2-1 above, the text *MAC should be able to aware of the UCI multiplexing in PHY based on UL skipping agreement* implies that MAC is aware of the multiplexing – which we are not sure and try to get feedback on by RAN2. But the proposed changes especially on Case 2-1 are not acceptable to us.**Overall, if we would just used posted the Qualcomm version from below (incl. removing the two paragraph) could have been fine for us.**  |
| ZTE | We share the same view with Samsung that it is not necessary to inform RAN2 about timeline issue. |
| Qualcomm | We agree with HW/HiSi and Nokia/NSB on case 2-1. It is not clear why the changes are made. We prefer the previously suggested wording for the LS. P.S. the above text has multiple typos. They can be fixed once the overall structure of the LS is decided.  |
| FL replies | Thanks a lot everyone’s input! Based on your comments, I changed back by using QC proposed wording for case 2-1 and action part.  |
| Ericsson | First, there is no MAC spec about RAN1 uplink skipping LS (R1-2009772) and the RAN2 LS was sent when RAN2 didn’t know about RAN1 uplink skipping agreement. Strictly speaking, it is sufficient to reply to RAN2 LS assuming uplink skipping LS is not applied. The discussion about uplink skipping is in anticipation of possible new RAN2 decision. We also do not see the need to mention timeline issue.Thus, we suggest having two sections, one section about existing MAC spec (for this RAN2 should already know how to understand MAC spec), the other section about yet-to-be-defined MAC spec when uplink skipping is considered (RAN2 may need to discuss, if they have not decided how to handle uplink skipping LS).1. When uplink skipping LS is not considered (or not enabled): this is simply interpretation of existing MAC. It seems that nobody believes that MAC is aware of the full set of PHY procedure. Thus RAN1 can express this understanding, and have RAN2 respond to confirm or revise RAN1 understanding. One set of description can cover all cases. For example, the text below (mostly copied from Case 2-1 bullet):

“If Rel-16 UL skipping (as in LS R1-2009772) is not enabled, MAC does not need to be aware of the UCI multiplexing in PHY, MAC does not need to know whether the final PUCCH overlaps with the PUSCH or not, MAC only knows configured PUCCH resource for SR. Therefore, MAC can decide to deliver SR or PUSCH. RAN1 confirms the behavior as described in RAN2 LS.”1. When uplink skipping LS is considered (or not enabled): no MAC spec exists for it. Neither RAN1 nor RAN2 knows exactly how MAC will handle it. RAN1 can share two different understandings from RAN1 perspective, and ask RAN2 how they’ll decide.

“If Rel-16 UL skipping (as in LS R1-2009772) is enabled, there are two issues :(A). Order of UL skipping-related check vs LCH based prioritization* + Understanding 1: the UL skipping-related check is prioritized over the LCH based prioritization check in MAC. Therefore, for case 2-2 and Case 3, if the PUSCH in the LS is expected to have UCI multiplexing, MAC does not prioritize SR over PUSCH, and send a MAC PDU to PUSCH instead.
	+ Understanding 2: LCH based prioritization check is prioritized over the UL skipping-related check in MAC. Therefore, for case 2-2 and Case 3, the SR in the LS is prioritized in MAC and is delivered and MAC shall not deliver the MAC PDU for the PUSCH.

(B) For the operation of LCH prioritization: does the UL skipping-related check change MAC awareness of PHY PUCCH/PUSCH multiplexing for each PUCCH and PUSCH? Below understanding (A)(2) is assumed to consider LCH prioritization only. * + Understanding 1: MAC is not aware of PHY PUCCH/PUSCH multiplexing for each PUCCH and PUSCH even when gNB and UE support UL skipping-related check. Therefore, the operation of LCH prioritization stays the same as when gNB and UE do not support UL skipping related check. For case 2-1 and 2-3(a), MAC is not aware that the final PUCCH resource and its location relative to PUSCH, and MAC can prioritize either SR or the overlapping PUSCH of the same PHY priority. For Case 2-3 (b), MAC is not aware that the final PUCCH resource overlaps with a PUSCH, and MAC can decide to trigger SR or not, without considering the PUSCH.
	+ Understanding 2: MAC is made aware of PHY PUCCH/PUSCH multiplexing for each PUCCH and PUSCH when gNB and UE support the UL skipping-related check. Therefore, for case 2-1, MAC is aware that the final PUCCH resource does not overlap with the PUSCH, and MAC can send both SR and PUSCH to PHY. For Case 2-3 (a) and 2-3 (b), MAC is aware that the final PUCCH resource still overlaps a PUSCH, and MAC does not prioritize SR over PUSCH.

 Case 2-3 (a) Case 2-3 (b) |

Appendix

Third round#2

**After checking all the views, it is difficult to be converged within the group. Some companies would like to confirm with RAN2 that UL skipping agreement should be prioritized over LCH based priority, while some companies think LCH based prioritization is specified in RAN2 and we need to consult with RAN2 views. One way I can consider is to provide current RAN1 discussion status in the reply LS and ask RAN2’s understanding. Delay the reply LS is not helpful to the progress. As noticed, compared with last meeting, the situation doesn’t change much. Therefore, I would like to encourage companies to accept this way. Any constructive comments are welcome!**

RAN1 had a discussion on following cases:

For case 1 of only SR overlaps with PUSCH of equal L1 priority,

* Understanding 1: some companies think that RAN1 can support the intended UE behavior as described in the LS, but some among these companies think it may have impacts on the PHY processing timeline.
* Understanding 2: some companies think whether to support this case is related to whether MAC can distinguish the case 1 and other cases e.g. case 2-1, case 2-2 and case 3 as discussed below that involving the resource overlapping with other PUCCH(s) carrying HARQ-ACK/CSI.

For case 2-1 of resource overlapping between PUSCH and SR of equal L1 priority, if there are other UCI(s) i.e., HARQ-ACK/CSI of the equal L1 priority overlapping with SR, and the final PUCCH resource after UCI multiplexing among different PUCCHs does not overlap with the PUSCH, there are two understandings.

* Understanding 1: MAC is not aware of the UCI multiplexing in PHY, MAC does not know whether the final PUCCH overlaps with the PUSCH or not, MAC only knows initial PUCCH resource for SR. Therefore, MAC can decide to deliver SR or PUSCH.
* Understanding 2: MAC is aware of the UCI multiplexing in PHY based on UL skipping agreement in R1-2009772. If MAC is aware that the final PUCCH resource does not overlap with the PUSCH, then for case 2-1, MAC can send both SR and PUSCH to PHY.

For case 2-1, some companies believe understanding 1 is correct MAC behavior. While some companies are not sure which understanding is the correct for the MAC behavior.

For other cases, i.e. case 2-2 and case 3, there are two understandings.

* Understanding 1: the UL skipping-related check is prioritized over the LCH based prioritization check in MAC. Therefore, if the PUSCH in the LS is expected to have UCI multiplexing, MAC does not prioritize SR over PUSCH, and send a MAC PDU to PUSCH instead.
* Understanding 2: LCH based prioritization check is prioritized over the UL skipping-related check in MAC. Therefore, the SR in the LS is prioritized in MAC and is delivered and MAC shall not deliver the MAC PDU for the PUSCH.

For above other cases, some companies believe understanding 1 is correct MAC behavior. While some companies are not sure which understanding is the correct for the MAC behavior.

**Action**

RAN1 respectfully ask RAN2 to provide their views on which understanding is correct for above case 2-1, case 2-2 and case 3.

Any comments?

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| Company | Comments  |
| Nokia/NSB | We think FL summarized the situation very well. We are supportive of the draft text above.  |
| CATT | We support above reply LS draft. |
| LG | We think this is best way we can for now. For case 2-1, we suggest to add a description or figure of both case 2-1(a) and (b) in order to get correct answer for Understanding 2.  |
| Qualcomm | RAN1 had a discussion on following cases:For case 1 of only SR overlaps with PUSCH of equal L1 priority,   ~~Understanding 1: some companies think that~~ From RAN1 point of view, the intended UE behavior as described in the LS can be supported. RAN1 will continue the discussion on any potential impact on the PHY layer including any change that might be needed for UE’s processing timeline.   For case 2-1 of resource overlapping between PUSCH and SR of equal L1 priority, if there are other UCI(s) i.e., HARQ-ACK/CSI of the equal L1 priority overlapping with SR, and the final PUCCH resource after UCI multiplexing among different PUCCHs does not overlap with the PUSCH, RAN1 has the following two understandings:   Understanding 1: MAC is not aware of the UCI multiplexing in PHY, MAC does not know whether the final PUCCH overlaps with the PUSCH or not, MAC only knows initial PUCCH resource for SR. Therefore, MAC can decide to deliver SR or PUSCH.    Understanding 2: MAC is aware of the UCI multiplexing in PHY based on UL skipping agreement in R1-2009772. If MAC is aware that the final PUCCH resource does not overlap with the PUSCH, then for case 2-1, MAC can send both SR and PUSCH to PHY.  For other cases, i.e. case 2-2 and case 3, RAN1 has the following two understandings:  Understanding 1: the UL skipping-related check is prioritized over the LCH based prioritization check in MAC. Therefore, if the PUSCH in the LS is expected to have UCI multiplexing, MAC does not prioritize SR over PUSCH, and send a MAC PDU to PUSCH instead.   Understanding 2: LCH based prioritization check is prioritized over the UL skipping-related check in MAC. Therefore, the SR in the LS is prioritized in MAC and is delivered and MAC shall not deliver the MAC PDU for the PUSCH.**Action** RAN1 respectfully ask RAN2 to provide their views on which understanding is the correct interpretation of the MAC specification, or to provide an alternate understanding, for above case 2-1, case 2-2 and case 3.  |
| Samsung | We are fine with QC’s update. However, we think that it is not necessary to inform RAN2 about timeline issue since RAN2 doesn’t care about this in RAN2 specification. In this sense, we would like to suggest remove following sentence. RAN1 will continue the discussion on any potential impact on the PHY layer including any change that might be needed for UE’s processing timeline. |