**3GPP TSG-RAN WG2 Meeting #112-eR2-20xxxxx**

**Online, 2 – 13 Nov, 2020**

Agenda Item: 6.5.3

Source: Huawei, HiSilicon

Title: Summary of [AT112-e][041][IIOT] MAC I

**Document for:** Discussion and Decision

# Introduction

This is the summary of the following email discussion:

* [AT112-e][041][IIOT] MAC I (Huawei)

Scope: Treat tdocs R2-2009500, R2-2009373, R2-2009375, R2-2009483 R2-20010054, R2-2009541, R2-2009374

Intended outcome: Intermediate: Determine agreeable parts. Final: For agreeable parts, agreed CRs.

Deadline: Intermediate deadline(s) by Rapporteur, Final: Thu Nov 12, 1200 UTC

R2-2009500 and R2-20010054 are not included in this email discussion as they have been treated online.

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|  |  |
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# Discussion

## CR on condition of a de-prioritized grant

R2-2009373 states that, in the current MAC spec, an uplink grant can be considered as a de-prioritized/prioritized uplink grant only if the MAC entity is configured with *lch-basedPrioritization*. It is suggested as: “For the MAC entity configured with *lch-basedPrioritization*” is added before the sentence “If the corresponding PUSCH transmission of a configured uplink grant is cancelled by CI-RNTI as specified in clause 11.2A of TS 38.213 [6] or cancelled by a high PHY-priority PUCCH transmission as specified in clause 9 of TS 38.213 [6], this uplink grant is considered as a de-prioritized uplink grant.”, in order to be aligned with other texts in the MAC spec.

**Q1 Do companies agree with the CR above?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree?**  **(Yes or No)** | **Comments** |
| LG | Yes |  |
| Nokia | Yes |  |
| Samsung | No (no strong view) | When lch-basedPrioritization is not configured, we don’t need to consider it is a de-prioritized uplink grant. But even if we consider it is a de-prioritized uplink grant, this classification is not used anywhere. It does not make anything broken in the current text.  So, we think this CR is a cosmetic change with text improvement. Thus we slight prefer not to do this. But no strong view. |
| Ericsson | No  Update in v11 (no strong view) | We do not see any issue in the current MAC spec to support autonomousTx **without** lch-basedPrioritzation. The grant is deprioritized due to PHY-related prioritization and this feature of autonomous transmission is technically not an LCH-based prioritization but rather a recovery mechanism for the deprioritized grant. We don’t think introducing this additional restriction brings any benefits and we prefer having flexibility for network implementation.  As a matter of fact, there is no configuration restriction in RRC saying that autonomousTx can only be configured when lch-basedPrioritzation is configured.  @Update in v11  Thanks for the comment below by Huawei and CATT. We agree with them that we miss the conditional presence in RRC and our understanding is not precise. Nevertheless, we share the same view as Samsung above that it is not a critical correction. |
| Sharp | Yes |  |
| ZTE | No | Share the same view with Samsung, if this can be accepted and which measns we shall only use the term of “prioritized” only if the Ich-basedPrioritizatation is configured , we shall change the SR part as well, for example:  ===== 38.321 ====================  1> else, for the SR configuration corresponding to the pending SR:  2> when the MAC entity has an SR transmission occasion on the valid PUCCH resource for SR configured; and  2> if *sr-ProhibitTimer* is not running at the time of the SR transmission occasion; and  2> if the PUCCH resource for the SR transmission occasion does not overlap with a measurement gap:  3> if the PUCCH resource for the SR transmission occasion overlaps with neither a UL-SCH resource nor an SL-SCH resource; or  3> if the MAC entity is able to perform this SR transmission simultaneously with the transmission of the SL-SCH resource; or  3> if the MAC entity is configured with *lch-basedPrioritization*, and the PUCCH resource for the SR transmission occasion does not overlap with an uplink grant received in a Random Access Response nor with the PUSCH duration of a MSGA payload, and the PUCCH resource for the SR transmission occasion for the pending SR triggered as specfied in clause 5.4.5 overlaps with any other UL-SCH resource(s), and the physical layer can signal the SR on one valid PUCCH resource for SR, and the priority of the logical channel that triggered SR is higher than the priority of the uplink grant(s) for any UL-SCH resource(s) where the uplink grant was not already de-prioritized, and the priority of the uplink grant is determined as specified in clause 5.4.1; or  <omit for short>  3> else:  4> consider the SR transmission as a de-prioritized SR transmission.  ========= From 38.321 ===================== |
| Huawei | Yes | According to RRC spec, the need code for autonomousTx is Cond LCH-BasedPrioritization, which means lch-BasedPrioritization is the prerequisite of autonomousTx.  autonomousTx-r16 ENUMERATED {enabled} OPTIONAL -- Cond LCH-BasedPrioritization  We have used “de-prioritized” almost from the beginning of the prioritization discussion.  It would be confusing to say an uplink grant is deprioritized or prioritized when the feature of lch-basedPrioritiztion is not configured for the UE. |
| OPPO | No | We share the similar view as Samsung. |
| Lenovo | No | Agree with ZTE, Samsung |
| CATT | Yes | If *lch-basedPrioritization* is not configured, UE behavior in such case is not clear.  And we agree with Huawei that Ericsson’s understanding that “autonomousTx can be supported without lch-basedPrioritzation” is not correct considering dependence of both parameters captured in RRC. |
| InterDigital | No | Agree with Samsung |
| III | No | Agree with Samsung |
| Xiaomi | Yes | Agree with Samung. But we slightly prefer to have clearer specification texts. |
| MediaTek | Yes | While we agree with Samsung that the classification of the grant as deprioritised may not have an impact later in the procedure, it is still quite odd that there is an action expected from the UE with no consequence. It is better to avoid such quirks in the specification. |
| Futurewei | Yes |  |
| Intel | Yes |  |
| vivo | No | Agree with Samsung and ZTE. The current spec is correct. |
| Qualcomm | No | Agree with Samsung that the current text is adequate. |
| Apple | Yes | Agree with MediaTek |

**Summary and Proposal:** **Within 19 participating companies, 10 companies said Yes, 7 companies said No, 2 companies (Ericsson, Samsung) said No (no strong view). There was no clear majority. Considering Samsung expressed no strong view in both their option choice and comments, and all No companies shared the same view as Samsung, the rapporteur proposes to agree this CR. We may further check on the “de-prioritized SR transmission” case raised by ZTE.**

## On the case when SR and PUSCH conflict

R2-2009483 discusses the case when the SR and PUSCH conflict, it is argued that:

If *lch-basedPrioritization* is configured, UE behavior on the SR and PUSCH conflict was clearly agreed in RAN2#108 meeting as below:

• For the SR&PUSCH with different LCH priority, MAC delivers SR or PUSCH to PHY based on the LCH priority;

• For the SR&PUSCH with equal LCH priority, MAC delivers PUSCH to PHY.

Accordingly, the below proposal is made:

**Proposal: UE MAC only provides SR or PUSCH to PHY when the SR and PUSCH resource are overlapped, i.e. no possibility to deliver both SR and PUSCH to PHY in the conflict case.**

**Q2 Do companies agree with the proposal above?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree?**  **(Yes or No)** | **Comments** |
| LG | Yes |  |
| Nokia | Yes | This is also our understanding, but do we need any change in MAC spec. to capture this? It seems quite clear already. |
| Samsung | No | This proposal is related to sequential generation scenario, e.g.  - at t1, MAC PDU is generated and deliverd to PHY. But PHY did not transmit PUSCH yet.  - at t2, SR with higher priority is triggered. There is sufficient timeline, so MAC instruct to signal the SR. MAC PDU is not transmitted.  We think the proposal prohibits this scenario by UE implementation. So we prefer not to agree anything.  Regarding LG’s comment, we agree there is no MAC impact. There may be a RAN1 impact of this proposal. |
| Ericsson | No | The agreement is copied below.  If PUCCH resource for an SR’s transmission occasion overlaps a UL-SCH resource, SR’s transmission is allowed (prioritized) based on a comparison of priority of the LCH that triggered the SR and a priority value for the UL-SCH resource (where the priority value is determined as in previous agreement), if the priority of the LCH that triggered the SR is higher.  This does not preclude the case where a PUSCH has started but there comes a SR in the middle of the PUSCH transmission that can cancel/puncture the PUSCH transmission. It might be worthwhile to confirm w/ Ran1 if this is supported and in which scenario is supported, e.g., might be okay if SR is high-PHY priority and PUSCH is low-PHY priority and might not be okay if both have the same PHY-priority. It is essentially the same exercise we have done for data-data prioritization. |
| Sharp | Yes | There is no MAC impact. |
| ZTE | Yes | No change on MAC is needed |
| Huawei | No | Agree with Samsung. It is possible that MAC PDU is generated for the PUSCH, then SR with higher LCH priority is triggered and the PUCCH for SR is overlapped with the PUSCH. PHY can transmit the SR if it is with higher L1 priority. |
| OPPO | No | Agree with Samsung. In normal case, MAC only delivers either SR or PUSCH to PHY layer. But, in case of SR&PUSCH with different LCH and PHY priority, if SR with a high priority is triggered after the delivery of MAC PDU associated to the overlapping PUSCH, and the PUSCH transmission can be cancelled, MAC can also deliver the SR to PHY layer, to assure the latency requirement of high priority message. |
| Lenovo | No | We have the same understanding as Samsung/Ericsson. Whether UE delivers both SR and PUSCH (MAC PDU) to PHY depends on the timing. |
| CATT | No | Same understanding as Ericsson that a PUSCH preempted by an SR is a valid RAN1/RAN2 scenario. |
| InterDigital | No | Agree with Samsung |
| III | No | Agree with Samsung |
| Xiaomi | No | Agree with Samsung and Ericsson. |
| MediaTek | No | Agree with Samsung and Ericsson |
| Futurewei | No | Agree with Samsung and Ericsson |
| Intel | No | Agree with Samsung and Ericsson. |
| vivo | No | Share the same views with Samsung and Ericsson. |
| QC | No | What is the MAC correction being discussed here? |
| Apple | Yes | Our preference is to keep the same operation as for the data/data collision case. Based on the agreement in RAN2#108, MAC always delivers either PUSCH or SR to PHY, but not both. Therefore, MAC is not required to deliver high-priority SR to PHY after sending PUSCH data to PHY for the overlapped case, or if it would do so then it’s up to UE implementation. |

**Summary and Proposal: Within 19 participating companies, 5 companies Yes, 14 companies No, there was clear majority. Proposal in R2-2009483 is not agreed.**

## On data & SR overlapping with equal L1 priority

R2-2009375 discusses the case when Data and SR overlap with equal L1 priority and SR is prioritized in MAC, it is stated that:

In Rel-16, if the priority of the logical channel that triggered SR is higher than the priority of the uplink grant, and the SR and the UL grant are of the same L1 priority, it is not clear whether PHY layer can signal SR if only SR is instructed to the PHY for transmission. If the PHY layer can signal SR, the MAC layer can instruct SR transmission to the PHY layer, otherwise the MAC layer will only deliver the data.

Accordingly, the below proposal is made:

**Proposal 1: RAN2 to confirm the intended UE behaviour for the case that the overlapped data and SR are of equal L1 priority and SR is prioritized in MAC, i.e. whether the MAC can instruct PHY for SR transmission.**

**Q3: Which below option on the intended UE behavior companies agree with, for the case when SR and data overlap with equal L1 priority and SR is prioritized in MAC?**

**Option 1: MAC can instruct PHY for SR transmission**

**Option 2: MAC deliver only the data to PHY for transmission**

**Other option(s):**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comments** |
| LG | 1 | We think there is no problem to send SR in PHY layer if MAC instructs SR transmission without delivering data. |
| Nokia | 1 | Since the SR has higher LCH priority than the UL grant, we should deliver SR only. This way we can have a MAC behavior that is consistent with data v.s. data conflict, i.e. deliver the one with higher LCH priority. |
| Samsung | 1 | LCH based prioritization didn’t assume PHY prioritization. So, we can say that we already considered the equal PHY priority case as a baseline. |
| Ericsson | 2 | The intention is the option 2, with the understanding that equal L1 priority of SR and PUSCH cannot be transmitted together in PHY (pending confirmation by RAN1). The below highlighted part is added in the last meeting to prevent option 1 (i.e., instructs an SR that is not transmitted anyhow by PHY)  3> if the MAC entity is configured with *lch-basedPrioritization*, and the PUCCH resource for the SR transmission occasion does not overlap with an uplink grant received in a Random Access Response nor with the PUSCH duration of a MSGA payload, and the PUCCH resource for the SR transmission occasion for the pending SR triggered as specfied in clause 5.4.5 overlaps with any other UL-SCH resource(s), and the physical layer can signal the SR on one valid PUCCH resource for SR, and the priority of the logical channel that triggered SR is higher than the priority of the uplink grant(s) for any UL-SCH resource(s) where the uplink grant was not already de-prioritized, and the priority of the uplink grant is determined as specified in clause 5.4.1; or  We are open to discuss how to resolve the discrepancy between RAN1 and RAN2 specs so that the intention is captured, with least spec change efforts. |
| Sharp | 1 | This is the intended UE behaviour of the agreement in RAN2#108 meeting:  • For the SR&PUSCH with different LCH priority, MAC delivers SR or PUSCH to PHY based on the LCH priority; |
| ZTE | 1 | As quoted by Ericsson, since it is not clear in RAN1 whether the SR is transmitted or not, thus using of “ the PHY layer can signal the SR on one valid PUCCH resource for SR” will cause the mutual ambiguities issue.  From implementation point of view, MAC can always generate one of them to instruct PHY to perform transmission based on the LCH based prioritization rule. |
| Huawei | 1 | We agree with Nokia that SR v.s. data with equal L1 priority can have a consistent behavior with data v.s. data with equal L1 priority. MAC shall deliver the SR to PHY for transmission if the SR has higher LCH priority. |
| OPPO | 2 | According to the achievements in RAN1#99 meeting, the conclusions on SR and the overlapping uplink grant are with same PHY priority is in the following:  *Agreement:*   * *For handling the overlapped UL transmissions among low PHY priority channel/signals, reuse the Rel-15 mechanism.*   *Working assumption:*   * *For handling the overlapped SR with high PHY priority and PUSCH with high PHY priority, no new mechanism in Rel-16 from RAN1 perspective.*    + *Can be revisited especially if there is update from RAN2*   It means that only data is allowed to deliver to PHY layer, if the PHY priority is same between SR and data. |
| Lenovo | 1 | Since MAC doesn’t consider L1 priority and L2 priority of SR is higher, we think that option 1 is the intended behavior. |
| CATT | 1 | This proposal extends the issue of MAC not delivering an expected PDU to PHY in the CG/DG collision case to the SR/PUSCH collision case. It should be the very same: if the SR is prioritized and MAC does not deliver the PDU, then PHY does not transmit the PUSCH and transmits PUCCH. |
| InterDigital | 1 | To be aligned with handling PUSCH collisions of the same L1 priority. |
| III | 1 | SR’s L2 priority is higher, so we think no problem with option 1. |
| Xiaomi | 1 | Option 2 breaks the rule of the LCH prioritization in MAC. |
| MediaTek | 1 | Agree with Nokia, i.e. Option 1 is consistent with our discussions and the LCH prioritization principles |
| Futurewei | 1 | Agree with Nokia |
| Intel | 1 | Agree with Nokia that Option 1 is consistent with LCH based prioritization principle. |
| vivo | 2 | Agree with Ericsson. In the coversheet of the agreed CR “R2-2008651”, it is stated:  For SR versus data, if the PHY-priority of the SR is equal to or lower than the PHY-priority of the PUSCH, then the SR cannot be transmitted. This is not captured yet. |
| QC | 2 | Agree with Ericsson’s argument. |
| Apple | 2 | We have the same understanding as Ericsson. For overlapping SR/PUSCH the PHY behavior is defined as SR is dropped and PUSCH is transmitted if SR and PUSCH have the same L1 priority and overlap in time. This is following Rel-15 behavior.  So, for equal L1 priority when LCH SR priority is higher, MAC would deliver SR only if “the physical layer can signal the SR on one valid PUCCH resource for SR", which is not the case for equal L1 priority. Hence in this case, according to the current specification MAC should not deliver SR and send the PUSCH instead. |

**Summary and Proposal:** **Within 19 companies, 14 companies choose option 1, and 5 companies support option 2. There was a clear majority to support option 1. We can send LS to RAN1 to resolve the discrepancy between RAN1 and RAN2 specs regarding this behavior.**

**Proposal 2: RAN2 to confirm the intended UE behavior as: for the case that the overlapped data and SR are of equal L1 priority and SR is prioritized in MAC, MAC can instruct PHY for SR transmission. Send LS to RAN1 based on this confirmation.**

## On configuring L2 priority and PHY priority

R2-2009541 discusses the configuration of L2 priority and PHY priority based on the below agreement:

* R2 assumes that PHY-based prioritization and LCH-based prioritization are configured independently and one can be configured without the other (assumption may be modified when LS reply from R1 is received)
* Postpone the discussion on additional conditions for Phy Priority and L2 priority feature (assume this can be added later).

It is argued that, there is no need for joint LCH based prioritization and PHY based prioritization, considering:

* The UE capability on LCH based and PHY based prioritization is separate.
* There are potential not complex solutions for only one of the two is configured.
* It is up to gNB implementation to assure LCH based prioritization and PHY based prioritization configured together.

Accordingly, the below proposal is made:

**Proposal 1 LCH based prioritization and PHY based prioritization can be configured independently.**

**Q4 Do companies agree with the proposal above?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree?**  **(Yes or No)** | **Comments** |
| LG | No | We don’t see any benefit in configuring only one of them. The purpose of IIOT WI is to ensure prioritized transmission of URLLC data, and if only one of them is configured, the WI purpose is not met. |
| Nokia | Yes | In practice we think it is the best to configure both of them to optimize intra-UE prioritization features. But from spec. point of view we probably don’t need to mandate such joint configuration, so we can have more gNB implementation flexibility. Besides, RAN2 has agreed before that they can be configured independently. |
| Samsung | Yes | Agree with Nokia |
| Ericsson | Yes | It is agreed in this meeting that   * No need to introduce additional configuration for Phy Priority and L2 priority feature.   It is our understanding that it is not feasible to have a joint configuration. |
| Sharp | Yes | Agree with Nokia. |
| ZTE | Yes | No more discussion |
| Huawei | Yes | Agree with Nokia |
| OPPO | Yes(proponent) | As we mentioned in the contribution, there is no need to jointly configure LCH based prioritization and PHY based prioritization. |
| Lenovo | Yes |  |
| CATT | Yes | Same view as Nokia: although we don’t see scenarios justifying this independence in practice, this issue has been discussed at length and no agreement could be achieved so far that both PHY and MAC prioritization should be jointly configured. Thus we are fine with following the majority of views. |
| InterDigital | Yes | Per the agreement. |
| III | Yes | Agree with Nokia. |
| Xiaomi | Yes | We understand that if the two parameters are not jointly configured, we may cause some error cases. However we think that the gNB by implementation could avoid the collision between the MAC and the PHY (e.g. via smart scheduling). |
| MediaTek | Yes |  |
| Futurewei | Yes | Agree with Nokia |
| Intel | Yes | Agree with Nokia. |
| vivo | Yes |  |
| QC | Yes |  |
| Apple | Based on UE capabilities | If the UE indicates support for both PHY-based and LCH-based prioritization the network should ensure that both mechanisms are configured together. This will a) limit the risk for errors due to potentially unaligned parameter settings or conflicting independent parameter updates and b) best utilize the benefits of both mechanisms for uplink prioritization of URLLC over eMBB. |

**Summary and Proposal:** **Within 19 participating companies, 17 said Yes, 1 said No and 1 said that network should configure both prioritizations together if UE can support, i.e., based on UE capabilities. There was clear majority to support independent configurations.**

**Proposal 3 LCH based prioritization and PHY based prioritization can be configured independently.**

## On explicit indication of PHY based prioritization

R2-2009374 discusses the configuration for physical layer prioritization and makes the below proposal:

It is stated that, when UE reports the capability parameter *ul-IntraUE-Mux-r16* to the network, the network can decide whether PHY based prioritization can be configured for the UE.

It is observed that, if any of the following parameters is configured by the network, PHY based prioritization shall be viewed as configured for the UE.

* *priorityIndicatiorDCI-0-1* in PUSCH-Config;
* *priorityIndicatiorDCI-0-2* in PUSCH-Config;
* *phy-PriorityIndex* in ConfiguredGrantConfig;
* *phy-PriorityIndex* in SchedulingRequestResourceConfig.

Accordingly the below proposal is made:

**Proposal 1: No explicit indication of PHY based prioritization is needed.**

**Q5 Do companies agree with the proposal above?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree?**  **(Yes or No)** | **Comments** |
| LG | Yes | We think it is already agreed in the online session. |
| Nokia | Yes | The agreement made online already captures this:   * No need to introduce additional configuration for Phy Priority and L2 priority feature. |
| Samsung | Yes | No need to discuss again |
| Ericsson | Yes |  |
| Sharp | Yes |  |
| ZTE | Yes | No more discussion |
| Huawei | Yes |  |
| OPPO | Yes |  |
| Lenovo | Yes |  |
| CATT | Yes | This was already agreed. |
| InterDigital | Yes |  |
| III | Yes |  |
| Xiaomi | Yes |  |
| MediaTek | Yes |  |
| Futurewei | Yes |  |
| Intel | Yes |  |
| vivo | Yes |  |
| QC | Yes |  |
| Apple | No | The parameters for PHY-based prioritization for are quite distributed and the parameter list above is also not complete. A global configuration parameter helps the UE to safely identify when PHY-based prioritization is enabled/disabled. |

**Summary and Proposal:** **Since the agreement made online already captures this and all companies except one support “No explicit indication of PHY based prioritization is needed.” No new proposal is needed.**

# Phase-1 proposals:

**After Phase-1 discussion, the following are proposed based on Q1, Q3 and Q4, no proposals based on Q2 and Q5:**

**Proposal 1: CR in R2-2009373 is endorsed.**

**Proposal 2: RAN2 to confirm the intended UE behavior as: for the case that the overlapped data and SR are of equal L1 priority and SR is prioritized in MAC, MAC can instruct PHY for SR transmission. Send LS to RAN1 based on this confirmation.**

**Proposal 3 LCH based prioritization and PHY based prioritization can be configured independently.**

# References

1. R2-2009373 Clarification on the condition of a de-prioritized grant Huawei, HiSilicon CR Rel-16 38.321 16.2.1 0928 - F NR\_IIOT-Core
2. R2-2009375 Clarification of PHY behaviour for Data & SR overlapping with equal L1 priority Huawei, HiSilicon discussion Rel-16 NR\_IIOT-Core
3. R2-2009483 Clarification on the SR and PUSCH conflict with equal LCH priority Apple discussion Rel-16 NR\_IIOT-Core
4. R2-2009541 Consideration on L2 priority and PHY priority feature OPPO discussion Rel-16 NR\_IIOT-Core
5. R2-2009374 Clarification of configuration for physical layer prioritization Huawei, HiSilicon discussion Rel-16 NR\_IIOT-Core.