**3GPP TSG-RAN WG2 Meeting #112 electronic R2-20XXXXX**

**Online, November 2 – 13, 2020**

**Agenda item: 6.5.3**

**Source: Samsung**

**Title: Report of Offline 042: MAC II (Samsung)**

**Document for: Discussion & Decision**

# Introduction

This document provides the summary report of the following discussion:

* [AT112-e][042][IIOT] MAC II (Samsung)

Scope: Treat tdocs, R2-2009599, R2-2009752, R2-2010525,R2-2009048, R2-2009372, R2-2010052,

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

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

Note that the rapporteur would like to postpone R2-2010525, because this issue is already under discussion in RAN1 and a pre-requisite UL skipping issue is under discussion in RAN2.

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# Discussion

## 2.1 Determination of Priority

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| [R2-2009599](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_112-e\Docs\R2-2009599.zip) Priority of Uplink Grant Samsung, Ericsson discussion Rel-16 NR\_IIOT-Core  [R2-2009752](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_112-e\Docs\R2-2009752.zip) Clarification of Grant Priority Determination Nokia, Nokia Shanghai Bell CR Rel-16 38.321 16.2.1 0939 - F NR\_IIOT-Core |

In the current MAC specification, the priority value of a MAC PDU could be determined based on the highest LCH priority of data that are multiplexed in the MAC PDU, or the highest LCH priority of data that can be multiplexed in the MAC PDU. This should depend on whether this MAC PDU to transmit is already generated and stored in the HARQ buffer. But the current text may not be so clear from the implementation perspective and the direct interpretation could be the choice is up to UE implementation. One misinterpretation can be that the grant priority is determined by the OLD data stored in the buffer. However, it is not the intended behaviour. Samsung/Ericsson (R2-2009599) and Nokia (2009752) proposed to clarify this, as follows:

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| R2-2009599  For the MAC entity configured with *lch-basedPrioritization*, priority of an uplink grant is determined by the highest priority among priorities of the logical channels that are multiplexed (i.e., the MAC PDU to transmit is already stored in the HARQ buffer of the uplink grant) or among priorities of the logical channels with data available that can be multiplexed in the MAC PDU, according to the mapping restrictions as described in clause 5.4.3.1.2 (i.e., the MAC PDU to transmit is not stored in the HARQ buffer of the uplink grant). The priority of an uplink grant for which no data for logical channels is multiplexed or can be multiplexed in the MAC PDU is lower than either the priority of an uplink grant for which data for any logical channels is multiplexed or can be multiplexed in the MAC PDU or the priority of the logical channel triggering an SR. |
| R2-2009752  For the MAC entity configured with *lch-basedPrioritization*, priority of an uplink grant is determined by the highest priority among priorities of the logical channels that are multiplexed in the MAC PDU if it is already generated or the highest priority among priorities of the logical channels with data available that can be multiplexed in the MAC PDU if it is not yet generated, according to the mapping restrictions as described in clause 5.4.3.1.2. The priority of an uplink grant for which no data for logical channels is multiplexed or can be multiplexed in the MAC PDU is lower than either the priority of an uplink grant for which data for any logical channels is multiplexed or can be multiplexed in the MAC PDU or the priority of the logical channel triggering an SR. |

**Q1a) Do companies agree the intention of R2-2009599 and R2-2009752?**

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| **Company** | **Yes/No** | **Comment** |
| Samsung | Yes | The problem is that we have to check if the MAC PDU to transmit is stored or not. The problem is very clear: checking if the MAC PDU to transmit is stored is not specified anywhere.  This TP is much simplified from Samsung’s previous TP discussed in the last meeting. We think this TP provides the clarification to avoid misintepretation. |
| Ericsson | Yes |  |
| ZTE | Yes | Okay for this. |
| OPPO | Yes |  |
| Nokia | Yes |  |
| Huawei | Yes |  |
| Xiaomi | Yes |  |
| CATT | Yes |  |
| Futurewei | Yes |  |
| Apple | Yes |  |
| ASUSTeK | Yes |  |

**Q1b) If your answer to Q1a is yes, please provide your preference on TP:**

1. **R2-2009599**
2. **R2-2009752**

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| **Company** | **A/B** | **Comment (or alternative TP)** |
| Samsung | A but | We slightly prefer A. But we are also fine with B with adding ”to transmit” as follow:  that are multiplexed in the MAC PDU to transmit if it is already generated |
| Ericsson | A | As the proponent company, we prefer option A. There is still a chance of misuderstaning of the second change part of the Option B: UE can consider that the PREVIOUS MAC PDU which is already in the buffer as the MAC PDU for this grant.  The difference that needs to be made clear is that if it is a grant for retransmission, then UE should consider the PREVIOUS MAC PDU; if it is a grant for new transmisison, then UE should NOT consider this PREVIOUS MAC PDU. In option A, the wording ”MAC PDU to transmit” is intended to make this distinction clear. |
| ZTE | B | Option B with improvement suggested by Samsung seems simpler. We can accept this. |
| OPPO | A but | We slightly prefer A, but we are also fine with Option B with the improvement suggested by Samsung. |
| Nokia | B with minor modification | We think overll Option B is slightly simpler, and the suggestion by Samsung makes sense, we could amend the sentence as:  that are multiplexed in the MAC PDU to be transmitted if it is already generated |
| Huawei | A but | In the TP A, ”the HARQ buffer of the uplink grant” is used. We think a HARQ buffer belongs to a HARQ process, instead of an uplink grant.  We suggest to modify ”the HARQ buffer of the uplink grant” as ”the HARQ buffer of the HARQ process associated with the uplink grant”. |
| Xiaomi | A |  |
| CATT | A | ...with proposed change by Huawei.  B with Samsung’s change is also fine though.  With these changes both do work so not strong view. |
| Futurewei | B | Slightly prefer B with the improvement from Samsung and Nokia, because the MAC PDU being generated (or not) is what matters here. |
| Apple | A with minor modification | We slightly prefer variant A as it makes the use of ”is multiplexed” and ”can be multiplexed” more visible; this is good because ”is multiplexed” and ”can be multiplexed” is used again in subsequent sentences. However, Nokia’s wording is simpler and more crisp, it can be acceptable to us as well!  We further propose to move the last paranthesis before the comma, including the change from Huawei, so that it becomes:  For the MAC entity configured with *lch-basedPrioritization*, priority of an uplink grant is determined by the highest priority among priorities of the logical channels that are multiplexed (i.e., when the MAC PDU to transmit is already stored in the HARQ buffer of the HARQ process associated with the uplink grant) or among priorities of the logical channels with data available that can be multiplexed in the MAC PDU (i.e., when the MAC PDU to transmit is not stored in the HARQ buffer of the HARQ process associated with the uplink grant), according to the mapping restrictions as described in clause 5.4.3.1.2. |
| ASUSTeK | A or modified B | We share the same view with Samsung. |
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## 2.2 Clarification on UL Grant Address to Temporary C-RNTI

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| [R2-2009372](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_112-e\Docs\R2-2009372.zip) Correction on resource overlapping with grants addressed to T-C-RNTI Huawei, HiSilicon CR Rel-16 38.321 16.2.1 0927 - F NR\_IIOT-Core |

In the current MAC spec, collision handling where a SR/CG overlaps with an uplink grant addressed to temporary C-RNTI is not clear (or not reflected). In R2-2009372, it is pointed out that priority comparison between a SR/CG and an uplink grant addressed to temporary C-RNTI may not be possible. Huawei proposed to add “uplink grant addressed to temporary C-RNTI” to the condition of possible collisions, as follows:

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| 5.4.1 UL Grant reception  …  For each Serving Cell and each configured uplink grant, if configured and activated, the MAC entity shall:  1> if the MAC entity is configured with *lch-basedPrioritization*, and the PUSCH duration of the configured uplink grant does not overlap with the PUSCH duration of an uplink grant received in a Random Access Response (or addressed to Temporary C-RNTI) for this Serving Cell or with the PUSCH duration of a MSGA payload; or  1> if the PUSCH duration of the configured uplink grant does not overlap with the PUSCH duration of an uplink grant received on the PDCCH or in a Random Access Response for this Serving Cell or with the PUSCH duration of a MSGA payload:  2> set the HARQ Process ID to the HARQ Process ID associated with this PUSCH duration;  2> if, for the corresponding HARQ process, the *configuredGrantTimer* is not running and *cg-RetransmissionTimer* is not configured (i.e. new transmission):  3> consider the NDI bit for the corresponding HARQ process to have been toggled;  3> deliver the configured uplink grant and the associated HARQ information to the HARQ entity.  5.4.2.1 HARQ Entity  …  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 addressed to Temporary C-RNTI, 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.  5.4.4 Scheduling Request  …  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 (or addressed to Temporary C-RNTI) 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 |

**Q2) Do companies agree with this change?**

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| **Company** | **Yes/No** | **Comment (or alternative TP)** |
| Samsung | No | From Rel-15, MAC spec has not use ”uplink grant addressed to TC-RNTI” for many places where uplink grant received in RAR is mentioned. The common understanding is that uplink grant received in RAR includes uplink grant addressed to TC-RNTI. We think we should keep the consistency with discussions in the past. |
| Ericsson | Yes with wording improvement of the TP | On the first change, the parentheses should be removed and be spelled out like below.  does not overlap with the PUSCH duration of an uplink grant received in a Random Access Response or with the PUSCH duration of an uplink grant addressed to Temporary C-RNTI for this Serving Cell or with the PUSCH duration of a MSGA payload; or  We wonder whether the wording ”addressed to temproray C-RNTI” has the same meaning as the other wording across the MAC PDU, such as ”an uplink grant for this Serving Cell has been received on the PDCCH for the MAC entity's C-RNTI or Temporary C-RNTI ” or ”the uplink grant was received on PDCCH for the C-RNTI” or “the received grant was not addressed to a Temporary C-RNTI on PDCCH”. A consistency checking might be needed.  The second change is not needed, since it is covered by the condition “a PUSCH duration of another uplink grant received on the PDCCH”  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 addressed to Temporary C-RNTI, or an uplink grant determined as specified in clause 5.1.2a for MSGA payload for this Serving Cell; or:  We have the same comment for the third change as for the first change. Note that the wording ”nor” is used here and should be aligned with the one above.  the PUCCH resource for the SR transmission occasion does not overlap with an uplink grant received in a Random Access Response (or addressed to Temporary C-RNTI) nor with the PUSCH duration of a MSGA payload,  @Samsung. Our understanding is that it is different, see the below example in 5.4.1.  1> if an uplink grant for this Serving Cell has been received on the PDCCH for the MAC entity's C-RNTI or Temporary C-RNTI; or  1> if an uplink grant has been received in a Random Access Response: |
| ZTE | Have no strong point of view | Can follow majorities |
| OPPO | No strong view for the first/third change,  No for the second change | For the first/third change, we have no strong opinion, but we hope we can have a common understanding on whether the uplink grant received in RAR includes uplink grant addressed to TC-RNTI?  For the second change, as mentioned by Ericsson, it is already covered by the condition “a PUSCH duration of another uplink grant received on the PDCCH” |
| Nokia | No for now | Although we agree with the intention, we also think some consistency checking is needed. |
| Huawei | Yes | We can agree with Ericsson’s improvement.  We have the same understanding with Ericsson about the relationship between RAR and uplink grant addressed to TC-RNTI. It is better to have a clear text considering we have the following agreement:  **A) For the collision with case UL grant received in RAR (or addressed to temporary C-RNTI) vs CG, the uplink grant in RAR is prioritized and used for transmission. (need text change).** |
| Xiaomi | Yes | We slightly prefer the text proposed by Ericsson. |
| CATT | Yes | Uplink grant with TC-RNTI is for Msg3 retransmission and uplink grant in RAR is for Msg3 initial transmission. They are different in implementation. We support to clarify this case, and agree with Ericsson’s wording improvements. |
| Futurewei | Yes with Ericsson’s improvement |  |
| Apple | Yes | With the improvement suggested by Ericsson. |
| ASUSTeK | Yes | We also agree with Ericsson and think the the parentheses should be removed. |
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## 2.3 Ignored Uplink Grant Scheduled with TC-RNTI

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| [R2-2009048](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_112-e\Docs\R2-2009048.zip) CR on 38.321 for the UL transmission scheduled with TC-RNTI ZTE Corporation, Sanechips CR Rel-16 38.321 16.2.1 0906 - F NR\_IIOT-Core |

An uplink grant addressed to TC-RNTI is not determined as either prioritized or de-prioritized. This means “uplink grant is not prioritized” would include “uplink grant addressed to TC-RNTI”. In R2-2009048, it is pointed out that uplink grant addressed to temporary C-RNTI is always ignored. ZTE proposed to change “not a prioritized uplink grant” to “a de-prioritized uplink grant”

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| 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 a depioritized uplink grant:  4> ignore the uplink grant.  3> else:  4> deliver the uplink grant and the HARQ information (redundancy version) of the TB to the identified HARQ process;  4> instruct the identified HARQ process to trigger a retransmission;  … |

**Q3) Do companies agree with this change?**

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| **Company** | **Yes/No** | **Comment (or alternative TP)** |
| Samsung | Yes but | According to 5.4.1, it is also possible that a normal retransmission resource (e.g. addressed to C-RNTI) is neither prioritized or de-prioritized. The thing is that evaluation whether it is prioritized is done immediately before the transmission.  For instance, let’s assume DG A (retransmission resource) overlaps with CG B and CG B is higher priority. But the evaluation of DG A is performed first and that of CG B will be done later.  Then, DG A is not a prioritized uplink grant but not a de-prioritized uplink grant at this time. So, the current text ”not a prioritized uplink grant” is necessary. Later, when CG B is evalauted, CG B becomes a prioritized uplink grant and DG A will be then de-prioritized. That’s current UE behaviour of 5.4.1.  But we agree with ZTE that uplink grant addressed to TC-RNTI will be ignored according to the current spec. We have to fix it. So, our suggestion is to specify it is not a resource scheduled gy TC-RNTI, as follows:  3> if the MAC entity is configured with *lch-basedPrioritization* and this uplink grant is not addressed to temporary C-RNTI, and this uplink grant is not a prioritized uplink grant: |
| Ericsson | Yes but | Agree that the uplink grant addressed to Temporary C-RNTI is wrongly skipped. In our view, Samsung’s TP seems better since it adresses the exactly identified problem while the proposed CR might have unexpected impacts related with the status (priortized, deprioritzed, neither prioirtzed nor depriortized) of other types of the grant. |
| ZTE | Yes, with improvement | It is better the correction is only aiming to the reason of the change. We can accept the suggestion from Samsung. |
| OPPO | Yes but | I agree with the intention, but prefer Samsung’s TP.  In addition, I wonder whether the case where the uplink grant is received in RAR is also excluded by the following text in subclause 5.4.2.1 in TS 38.321?  <omitted >  3> else if the MAC entity is not configured with *lch-basedPrioritization*; or  3> if this uplink grant is a prioritized uplink grant:  4> obtain the MAC PDU to transmit from the Multiplexing and assembly entity, if any;  3> if a MAC PDU to transmit has been obtained:  4> if the uplink grant is not a configured grant configured with *autonomousTx*; or  4> if the uplink grant is a prioritized uplink grant:  5> deliver the MAC PDU and the uplink grant and the HARQ information of the TB to the identified HARQ process;  5> instruct the identified HARQ process to trigger a new transmission;  5> if the uplink grant is a configured uplink grant:  6> start or restart the *configuredGrantTimer*, if configured, for the corresponding HARQ process when the transmission is performed if LBT failure indication is not received from lower layers;  6> start or restart the *cg-RetransmissionTimer*, if configured, for the corresponding HARQ process when the transmission is performed if LBT failure indication is not received from lower layers.  <omitted for short> |
| Nokia | Yes with modification | Agree with Samsung’s suggestion, this avoids ambiguity. |
| Huawei | Yes | We can also accept Samsung’s suggestion. |
| Xiaomi | Yes | We prefer Samsung’s text. |
| CATT | Yes but | We agree to fix the issue but would prefer a clearer statement that UL grants to TC-RNTI are always prioritized, for example in 5.4.1:  When the MAC entity is configured with *lch-basedPrioritization*, for each uplink grant whose associated PUSCH can be transmitted by lower layers, the MAC entity shall:  1>  if this uplink grant is addressed to Temporary C-RNTI:  2>  consider this uplink grant as a prioritized uplink grant;  2>  consider the other overlapping uplink grant(s), if any, as a de-prioritized uplink grant(s);  2> consider the other overlapping SR transmission(s), if any, as a de-prioritized SR transmission(s).  1>  else if this uplink grant is addressed to CS-RNTI with NDI = 1 or C-RNTI:  2>  if there is no overlapping PUSCH duration of a configured uplink grant which was not already de-prioritized, in the same BWP whose priority is higher than the priority of the uplink grant; and  2>  if there is no overlapping PUCCH resource with an SR transmission which was not already de-prioritized and the priority of the logical channel that triggered the SR is higher than the priority of the uplink grant:  3>  consider this uplink grant as a prioritized uplink grant;  3>  consider the other overlapping uplink grant(s), if any, as a de-prioritized uplink grant(s);  3>  consider the other overlapping SR transmission(s), if any, as a de-prioritized SR transmission(s). |
| Futurewei | Yes with Samsung’s improvement |  |
| Apple | Yes, with modification | We acknowledge the problem needs to be fixed. The variant suggested by Samsung looks good. |
| ASUSTeK | Yes with modification | We agree with the intention and prefer Samsung’s suggestion. |

## 2.4 SPS HPI Calculation

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| [R2-2010052](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_112-e\Docs\R2-2010052.zip) Correction for SPS HARQ process ID calculation Ericsson CR Rel-16 38.321 16.2.1 0957 - F NR\_IIOT-Core |

NOTE 1 in 5.3.1 applies for DL SPS HPI calculation irrespective of *harq-ProcID-Offset*. But NOTE 1 is written after the rule without *harq-ProcID-Offset*, which may misunderstand NOTE 1 applies only for the case without *harq-ProcID-Offset*. Ericsson proposed to move this note down to before NOTE 2, as follows:

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| For configured downlink assignments without *harq-ProcID-Offset*, the HARQ Process ID associated with the slot where the DL transmission starts is derived from the following equation:  HARQ Process ID = [floor (CURRENT\_slot × 10 / (*numberOfSlotsPerFrame* × *periodicity*))] modulo *nrofHARQ-Processes*  where CURRENT\_slot = [(SFN × *numberOfSlotsPerFrame*) + slot number in the frame] and *numberOfSlotsPerFrame* refers to the number of consecutive slots per frame as specified in TS 38.211 [8].  For configured downlink assignments with *harq-ProcID-Offset*, the HARQ Process ID associated with the slot where the DL transmission starts is derived from the following equation:  HARQ Process ID = [floor (CURRENT\_slot × 10 / (*numberOfSlotsPerFrame* × *periodicity*))] modulo *nrofHARQ-Processes* + *harq-ProcID-Offset*  where CURRENT\_slot = [(SFN × *numberOfSlotsPerFrame*) + slot number in the frame] and *numberOfSlotsPerFrame* refers to the number of consecutive slots per frame as specified in TS 38.211 [8].  NOTE 1: In case of unaligned SFN across carriers in a cell group, the SFN of the concerned Serving Cell is used to calculate the HARQ Process ID used for configured downlink assignments.  NOTE 2: CURRENT\_slot refers to the slot index of the first transmission occasion of a bundle of configured downlink assignment. |

**Q4) Do companies agree with this change?**

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| **Company** | **Yes/No** | **Comment (or alternative TP)** |
| Samsung | Yes |  |
| Ericsson | Yes |  |
| ZTE | Yes |  |
| OPPO | Yes |  |
| Nokia | Yes |  |
| Huawei | Yes |  |
| Xiaomi | Yes |  |
| CATT | Yes |  |
| Futurewei | Yes |  |
| Apple | Yes | There is a small typo in the CR’s reason for change where “Note 1” is missing from the last sentence. It should read: “It is not clear if [Note 1] applies also to the rule with harq-ProcID-Offset.” |
| ASUSTeK | Yes |  |

# Conclusion