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

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

**Agenda Item: 7.2.2**

**Source: Moderator (Huawei)**

**Title: Feature lead summary#1 on NR-U HARQ and Multi-PUSCH maintenance**

**Document for: Discussion and Decision**

# Introduction

Corrections on NR-U HARQ and Multi-PUSCH scheduling have been submitted at RAN1#104 e-meeting. This first summary provides a list of submitted corrections and asks for companies’ views on the criticality of the proposed corrections during the preparation phase (January 19th – 22nd).

The corrections proposed at RAN1#104e are the following:

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| Issue # | Issue summary | Contributions |
| NRU-HARQ1 | Whether a correction is needed to specify the UE assumption on the values of NFI and DAI for a non-scheduled PDSCH group (in case of reporting enhanced Type 2 HARQ-ACK codebook in PUSCH or PUCCH). Discussed as issue A9 in the past. | R1-2100408  R1-2100891 |
| NRU-HARQ2 | Whether there is a need to address FFS: Type-3 codebook with NDI where the UE has not yet obtained HARQ-ACK information for a TB corresponding to a scheduled PDSCH reception. Discussed as issue B4 in the past. | R1-2100071  R1-2100148  R1-2100628  R1-2100891 |
| NRU-HARQ3 | Corrections on Type-3 HARQ-ACK codebook (broken down into 5 issues, see section 2.3) | R1-2100331 |
| NRU-HARQ4 | Corrections on power control for enhanced Type 2 and for Type-3 HARQ-ACK codebook (broken down into 4 questions, see section 2.4) | R1-2100332 |
| MultiPUSCH | Corrections on multi-PUSCH scheduling:   * Issue 1: possible ambiguity in the TDRA bitfield size in relation to *pusch-TimeDomainAllocationListForMultiPUSCH* * Issue 2: possible reference to a wrong RRC parameter instead of *pusch-TimeDomainAllocationListForMultiPUSCH* * Issue 3: possible ambiguous UE behaviour in case of simultaneous configuration of semi-static repetitions (with *pusch-AggregationFactor)* and *pusch-TimeDomainAllocationListForMultiPUSCH* | R1-2100071  R1-2100408  R1-2101651 |

Section 2 provides a summary of the issues and an initial assessment from the Feature Lead (see “FL questions”). Tables are provided for each issue to collect companies’ views. Section 3 provides a table for companies to provide their view (Y or N) on the criticality/essentiality of each issue. **Deadline for feedback is January 21 at UTC 4:59pm**.

# Summary of corrections proposed at RAN1#103e

## NRU-HARQ1 (issue A9)

R1-2100891 (LG) and R1-2100408 (Vivo) discussed a topic from previous issue A9, whether UE should ignore the NFI and DAI fields for the non-scheduled group in a DL DCI with q=0. The proposals are the same as submitted at RAN1#103e. At RAN1#103e, there was no consensus that this would require an essential correction. The preparation phase of RAN1#104e should determine whether companies’ views have changed.

FL proposal: decide in preparation phase whether a correction is needed

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| **Company** | **Summary of proposals and companies’ views** |
| LG  R1-2100891 | Proposal 1: For the case when a PDSCH group is not scheduled at UE side and the PDSCH group corresponds to the T-DAI in UL grant DCI, one of the following alternatives is adopted.   * Alt 1: NFI value for the PDSCH group is assumed to be non-toggled from the latest value.   + Payload size of the HARQ-ACK on PUSCH is determined by the indicated T-DAI itself without accumulating the HARQ-ACKs in the previous PUCCH occasion. * Alt 2: NFI (for the PDSCH group) is signaled via the UL DCI (as for DL DCI) |
| Vivo  R1-2100408 | Proposal 1: For enhanced dynamic codebook, UE should ignore the NFI and DAI fields for the non-scheduled group in a DL DCI with q=0, and assume that the DL DCI does not include or provide an NFI for the non-scheduled group. |

## NRU-HARQ2 (issue B4)

R1-2100071 (ZTE), R1-2100148 (OPPO), R1-2100628 (Intel), R1-2100891 (LG) discussed the FFS point on the agreement made at RAN1#100e (issue B4 in previous meetings):

* FFS: Type-3 codebook with NDI where the UE has not yet obtained HARQ-ACK information for a TB corresponding to a scheduled PDSCH reception

The proposals are re-submitted from RAN1#103e. Intel summarized 3 options for Type3 HARQ-ACK codebook if a DCI is detected but the scheduled PDSCH cannot be decoded with sufficient processing time before the PUCCH:

* Option 1: UE reports NACK.
* Option 2: If the NDI in the latest detected DCI is NOT toggled, UE report the actual HARQ-ACK of the last received PDSCH; otherwise, UE report NACK.
* Option 3: up to UE to decide on the reported HARQ-ACK value.

Intel supports down-selecting between Option 2 and Option 3. LG supports option 2 (for the Type-3 HARQ-ACK codebook without NDI inclusion). ZTE and OPPO support option 1.

Six companies contributing on this topic at RAN1#103e vs. 4 companies at RAN1#104e. The proposals are still not aligned. At RAN1#103e, there was no consensus that this would require an essential correction. The preparation phase of RAN1#104e should determine whether companies’ views have changed.

FL proposal: decide in preparation phase whether a correction is needed

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| **Company** | **Summary of proposals and companies’ views** |
| ZTE  R1-2100071 | UE shall report NACK for the cases where the UE has not yet obtained HARQ-ACK information for a TB corresponding to a scheduled PDSCH reception  < Start of text proposal for 38.213>  9.1.4 Type-3 HARQ-ACK codebook determination  \*\*\* Unchanged text omitted \*\*\*  if  while  if UE has reported HARQ-ACK information for TB for HARQ process number on serving cell , and has not subsequently detected a DCI format scheduling a PDSCH reception, or received a SPS PDSCH, with TB for HARQ process number on serving cell , or UE has not yet obtained HARQ-ACK information for a TB corresponding to a scheduled PDSCH reception  while        end while  end if  if UE has obtained HARQ-ACK information for TB for HARQ process number on serving cell corresponding to a PDSCH reception and has not reported the HARQ-ACK information corresponding to the PDSCH reception  while  = HARQ-ACK information bit for CBG of TB for HARQ process number of serving cell      end while  end if      end while  else  while  if UE has reported HARQ-ACK information for TB for HARQ process number on serving cell and has not subsequently detected a DCI format scheduling a PDSCH reception, or received a SPS PDSCH, with TB for HARQ process number on serving cell , or UE has not yet obtained HARQ-ACK information for a TB corresponding to a scheduled PDSCH reception  = NACK      end if  < End of text proposal 1> | |
| OPPO  R1-2100148 | Proposal 2: Adopt TP1 for the generation of type-3 HARQ-ACK codebook.   * If the UE has not obtained HARQ-ACK information for a given HARQ process, NACK should be feedback for the given HARQ process.   --------------------------------- Start of TP1 38.213 V16.3.0 section 9.1.4-----------------------------9.1.4 Type-3 HARQ-ACK codebook determination  <Unchanged parts are omitted>  else  if  while  if UE has reported HARQ-ACK information for TB for HARQ process number on serving cell , and has not subsequently detected a DCI format scheduling a PDSCH reception, or received a SPS PDSCH, with TB for HARQ process number on serving cell  while        end while  end if  if UE has obtained HARQ-ACK information for TB for HARQ process number on serving cell corresponding to a PDSCH reception and has not reported the HARQ-ACK information corresponding to the PDSCH reception  while  = HARQ-ACK information bit for CBG of TB for HARQ process number of serving cell      end while  elseif UE has not obtained HARQ-ACK information for TB for HARQ process number on serving cell  while        end while  end if      end while  else  while  if UE has reported HARQ-ACK information for TB for HARQ process number on serving cell and has not subsequently detected a DCI format scheduling a PDSCH reception, or received a SPS PDSCH, with TB for HARQ process number on serving cell  = NACK      end if  if UE has obtained HARQ-ACK information for TB for HARQ process number on serving cell corresponding to a PDSCH reception and has not reported the HARQ-ACK information corresponding to the PDSCH reception  if *harq-ACK-SpatialBundlingPUCCH* is not provided  = HARQ-ACK information bit for TB for HARQ process of serving cell  else  = binary AND operation of the HARQ-ACK information bits corresponding to first and second transport blocks for HARQ process of serving cell . If the UE receives one transport block, the UE assumes ACK for the second transport block  end if      elseif UE has not obtained HARQ-ACK information for TB for HARQ process number on serving cell  = NACK      end if  end while  end if    end if    end while      end while  ---------------------------------End of TP 1 38.213 V16.3.0 section 9.1.4----------------------------- | |
| LG  R1-2100891 | Proposal 2: For one-shot Type-3 HARQ-ACK codebook without NDI inclusion, following UE behaviour is to be specified for the cases where the UE has not yet obtained HARQ-ACK information for a TB corresponding to a scheduled PDSCH reception.  - HARQ-ACK is reset to NACK if the NDI value for the TB is toggled.  - HARQ-ACK is kept as previous report if the NDI value is not toggled | |
| Intel  R1-2100628 | Proposal 1: In Type3 HARQ-ACK codebook, it is allowed that DCI is detected but the scheduled PDSCH cannot be decoded with sufficient processing time before the PUCCH.  Proposal 2: If DCI is detected but the scheduled PDSCH cannot be decoded with sufficient processing time before the PUCCH, down-select between Option 2 and Option 3.   * Option 1: UE reports NACK. * Option 2: If the NDI in the latest detected DCI is NOT toggled, UE report the actual HARQ-ACK of the last received PDSCH; otherwise, UE report NACK. * Option 3: up to UE to decide on the reported HARQ-ACK value.   Text proposal for section 9.1.4 in 38.213-g10.  …  if UE has reported HARQ-ACK information for TB for HARQ process number on serving cell , and has not subsequently detected a DCI format scheduling a PDSCH reception with non-toggled NDI, or has not received a SPS PDSCH, with TB for HARQ process number on serving cell  while        end while  ~~end if~~  else ~~if UE has obtained HARQ-ACK information for TB for HARQ process number on serving cell corresponding to a PDSCH reception and has not reported the HARQ-ACK information corresponding to the PDSCH reception~~  while  = HARQ-ACK information bit for CBG of TB for HARQ process number of serving cell      end while  end if  …  if UE has reported HARQ-ACK information for TB for HARQ process number on serving cell and has not subsequently detected a DCI format scheduling a PDSCH reception with non-toggled NDI, or has not received a SPS PDSCH, with TB for HARQ process number on serving cell  = NACK      ~~end if~~  else ~~if UE has obtained HARQ-ACK information for TB for HARQ process number on serving cell corresponding to a PDSCH reception and has not reported the HARQ-ACK information corresponding to the PDSCH reception~~  = HARQ-ACK information bit for TB for HARQ process of serving cell      end if | |

## NRU-HARQ3 (Type-3 CB)

R1-2100331 (CATT) proposes 5 corrections related to Type-3 HARQ-ACK codebook, as summarized below. Companies are invited to provide their views on the issues proposed in R1-2100331 in each table.

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| **HARQ3-issue1** | **Summary of proposals and companies’ views** |
| R1-2100331 | Issue 1: In current specification for a Type-3 HARQ-ACK codebook, the HARQ-ACK feedback generation for a PDSCH with one transport block is missing if .  Proposal: Add the UE behavior of HARQ-ACK generation for a PDSCH with one transport block if  Proposed TP: If , when a UE receives a PDSCH with one transport block, the HARQ-ACK information is associated with the first transport block and the UE generates a NACK for the second transport block. |
| FL questions | Why the proposed correction is not directly included in the pseudo-code of section 9.1.4?  Could the proponent point out where the problem occurs in the pseudo-code?  Does the problem depend on the configuration of NDI reporting, spatial bundling, or CBG? |
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| **HARQ3- issues 2&3** | **Summary of proposals and companies’ views** |
| R1-2100331 | Issue 2: DCI format 1\_1 indicating a request for a Type-3 HARQ-ACK codebook report without scheduling PDSCH does not need to be included in the paragraph of definition in Clause 9.2.5 since such DCI itself does not require HARQ-ACK feedback.  Issue 3: The DCI format 1\_1 indicating a request for a Type-3 HARQ-ACK codebook report without scheduling PDSCH is missing in the paragraphs of definition in Clause 9.2.5.  Proposed TP:  **9.2.5 UE procedure for reporting multiple UCI types**  < Unchanged part is omitted >  If a UE would transmit multiple overlapping PUCCHs in a slot or overlapping PUCCH(s) and PUSCH(s) in a slot and, when applicable as described in Clauses 9.2.5.1 and 9.2.5.2, the UE is configured to multiplex different UCI types in one PUCCH, and at least one of the multiple overlapping PUCCHs or PUSCHs is in response to a DCI format detection by the UE, the UE multiplexes all corresponding UCI types if the following conditions are met. If one of the PUCCH transmissions or PUSCH transmissions is in response to a DCI format detection by the UE, the UE expects that the first symbol of the earliest PUCCH or PUSCH, among a group overlapping PUCCHs and PUSCHs in the slot, satisfies the following timeline conditions  - is not before a symbol with CP starting after after a last symbol of any corresponding PDSCH, is given by maximum of where for the i-th PDSCH with corresponding HARQ-ACK transmission on a PUCCH which is in the group of overlapping PUCCHs and PUSCHs, , is selected for the i-th PDSCH following [6, TS 38.214], is selected based on the UE PDSCH processing capability of the i-th PDSCH and SCS configuration , where corresponds to the smallest SCS configuration among the SCS configurations used for the PDCCH scheduling the i-th PDSCH, the i-th PDSCH, the PUCCH with corresponding HARQ-ACK transmission for the i-th PDSCH, and all PUSCHs in the group of overlapping PUCCHs and PUSCHs.  - is not before a symbol with CP starting after after a last symbol of any corresponding SPS PDSCH release or of a DCI format 1\_1 indicating SCell dormancy as described in Clause 10.3. is given by maximum of where for the i-th PDCCH providing the SPS PDSCH release or the DCI format 1\_1 with corresponding HARQ-ACK transmission on a PUCCH which is in the group of overlapping PUCCHs and PUSCHs, , as described in Clause 10.2, or the DCI format 1\_1 indicating SCell dormancy without scheduling a PDSCH reception as described in Clause 10.3, where corresponds to the smallest SCS configuration among the SCS configurations used for the PDCCH providing the i-th SPS PDSCH release or the DCI format 1\_1, the PUCCH with corresponding HARQ-ACK transmission for the i-th SPS PDSCH release or the DCI format 1\_1, and all PUSCHs in the group of overlapping PUCCHs and PUSCHs.  - if there is no aperiodic CSI report multiplexed in a PUSCH in the group of overlapping PUCCHs and PUSCHs, is not before a symbol with CP starting after after a last symbol of  - any PDCCH with the DCI format scheduling an overlapping PUSCH, and  - any PDCCH scheduling a PDSCH or SPS PDSCH release, or a DCI format 1\_1 indicating SCell dormancy, or a DCI format 1\_1 indicating a request for a Type-3 HARQ-ACK codebook report without scheduling PDSCH, with corresponding HARQ-ACK information in an overlapping PUCCH in the slot  If there is at least one PUSCH in the group of overlapping PUCCHs and PUSCHs, is given by maximum of where for the i-th PUSCH which is in the group of overlapping PUCCHs and PUSCHs, , , and are selected for the i-th PUSCH following [6, TS 38.214], is selected based on the UE PUSCH processing capability of the i-th PUSCH and SCS configuration , where  corresponds to the smallest SCS configuration among the SCS configurations used for the PDCCH scheduling the i-th PUSCH, the PDCCHs scheduling the PDSCHs or providing the SPS PDSCH releases or providing the SCell dormancy indication or providing the indication of a request for a Type-3 HARQ-ACK codebook report without scheduling PDSCH with corresponding HARQ-ACK transmission on a PUCCH which is in the group of overlapping PUCCHs/PUSCHs, and all PUSCHs in the group of overlapping PUCCHs and PUSCHs.  If there is no PUSCH in the group of overlapping PUCCHs and PUSCHs, is given by maximum of where for the i-th PDSCH or the i-th SPS PDSCH release or the i-th SCell dormancy indication or the i-th indication of a request for a Type-3 HARQ-ACK codebook report without scheduling PDSCH with corresponding HARQ-ACK transmission on a PUCCH which is in the group of overlapping PUCCHs, , is selected based on the UE PUSCH processing capability of the PUCCH serving cell if configured.   is selected based on the UE PUSCH processing capability 1, if PUSCH processing capability is not configured for the PUCCH serving cell. is selected based on the smallest SCS configuration between the SCS configuration used for the PDCCH scheduling the i-th PDSCH or providing the i-th SPS PDSCH release or providing the i-th SCell dormancy indication or providing the i-th indication of a request for a Type-3 HARQ-ACK codebook report without scheduling PDSCH with corresponding HARQ-ACK transmission on a PUCCH which is in the group of overlapping PUCCHs, and the SCS configuration for the PUCCH serving cell.  - if there is an aperiodic CSI report multiplexed in a PUSCH in the group of overlapping PUCCHs and PUSCHs, is not before a symbol with CP starting after after a last symbol of  - any PDCCH with the DCI format scheduling an overlapping PUSCH, and  - any PDCCH scheduling a PDSCH, or SPS PDSCH release, or providing a DCI format 1\_1 indicating SCell dormancy, or a DCI format 1\_1 indicating a request for a Type-3 HARQ-ACK codebook report without scheduling PDSCH, with corresponding HARQ-ACK information in an overlapping PUCCH in the slot  where corresponds to the smallest SCS configuration among the SCS configuration of the PDCCHs, the smallest SCS configuration for the group of the overlapping PUSCHs, and the smallest SCS configuration of CSI-RS associated with the DCI format scheduling the PUSCH with the multiplexed aperiodic CSI report, and for , for and for  - , , , , , and are defined in [6, TS 38.214], is applied only if of table 5.4-1 in [6, TS 38.214] is applied to the determination of , and and are defined in [4, TS 38.211].  < Unchanged part is omitted > |
| FL questions | The proposed TP is partially undoing the TP agreed at RAN1#102e in R1-2007101 based on the discussion on issue B18 as summarized in R1-2007070 for email discussion [102-e-NR-unlic-NRU-HARQ-01]. It is the FL’s understanding that without the TP agreed in R1-2007101, the UCI reporting timeline would be undefined for type 3 HARQ-ACK codebook triggered by a DCI that doesn’t scheduling a PDSCH.  At the same time the TP adds text reading “or providing the indication of a request for a Type-3 HARQ-ACK codebook report without scheduling PDSCH”. This text was also discussed in R1-2007070 but not included in the final TP agreed in R1-2007101 for the reason summarized by Qualcomm and copied here for reference:  *With respect to the TP, we think anywhere in this section that SPS release timeline is mentioned, “or a request for a Type-3 HARQ-Ack codebook report without scheduling PDSCH” should be also added. However, there are instances in the above TP that SPS release timeline is not there but Type-3 HARQ-Ack w/o PDSCH scheduling timeline is added, e.g.,*  *“the PDCCHs scheduling the PDSCHs or a request for a Type-3 HARQ-ACK codebook report with”*  *Even though these instances are not technically incorrect, it creates inconsistency, and questions will be asked later as to why only Type-3 HARQ-Ack w/o PDSCH scheduling is mentioned while SPS release is not mentioned. There seem to be already some inconsistency wrt SPS release vs Scell dormancy being mentioned in this Section (but not sure if in this agenda item, whether we should try to fix those or not)*  It should be decided whether the issue should be fixed not only for Type-3 HARQ-ACK codebook but also for SPS release, or whether the existing inconsistency is not critical. |
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| **HARQ3-issue4** | **Summary of proposals and companies’ views** |
| R1-2100331 | Issue 4: Type-3 HARQ-ACK codebook report is missing when there is only one PUCCH resource set configured for HARQ-ACK transmission in Clause 9.2.5.2.  Proposed TP:  **9.2.5.2 UE procedure for multiplexing HARQ-ACK/SR/CSI in a PUCCH**  For a transmission occasion of a single CSI report, a PUCCH resource is provided by *pucch-CSI-ResourceList*. For a transmission occasion of multiple CSI reports, corresponding PUCCH resources can be provided by *multi-CSI-PUCCH-ResourceList*. If a UE is provided first and second *PUCCH-Config*, *multi-CSI-PUCCH-ResourceList* is provided by the first *PUCCH-Config*, and *PUCCH-ResourceId* in *pucch-CSI-ResourceList* or *multi-CSI-PUCCH-ResourceList* indicates a corresponding PUCCH resource in *PUCCH-Resource* provided by the first *PUCCH-Config*.  If a UE is provided only one PUCCH resource set for transmission of HARQ-ACK information in response to PDSCH reception scheduled by a DCI format or in response to a SPS PDSCH release or in response to a SCell dormancy indication or in response to a request for a Type-3 HARQ-ACK codebook report, the UE does not expect to be provided *simultaneousHARQ-ACK-CSI*.  < Unchanged part is omitted > |
| FL questions | The issue seems valid. Companies’ views are requested. |
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| **HARQ3-issue5** | **Summary of proposals and companies’ views** |
| R1-2100331 | Issue 5: The DCI format 1\_1 indicating a request for a Type-3 HARQ-ACK codebook report without scheduling PDSCH is missing in the paragraphs of CORESET configuration and search space sharing in Clause 10.1.  Proposed TP:  **10.1 UE procedure for determining physical downlink control channel assignment**  < Unchanged part is omitted >  For each CORESET, the UE is provided the following by *ControlResourceSet*:  - a CORESET index , by *controlResourceSetId*  or by *controlResourceSetId-v1610*, where  - if *coresetPoolIndex* is not provided, or if a value of *coresetPoolIndex* is same for all CORESETs if *coresetPoolIndex* is provided;  - if *coresetPoolIndex* is not provided for a first CORESET, or is provided and has a value 0 for a first CORESET, and is provided and has a value 1 for a second CORESET;  - a DM-RS scrambling sequence initialization value by *pdcch-DMRS-ScramblingID*;  - a precoder granularity for a number of REGs in the frequency domain where the UE can assume use of a same DM-RS precoder by *precoderGranularity*;  - a number of consecutive symbols provided by *duration*;  - a set of resource blocks provided by *frequencyDomainResources*;  - CCE-to-REG mapping parameters provided by *cce-REG-MappingType*;  - an antenna port quasi co-location, from a set of antenna port quasi co-locations provided by *TCI-State*, indicating quasi co-location information of the DM-RS antenna port for PDCCH reception in a respective CORESET;  - if the UE is provided by *simultaneousTCI-UpdateList1* or *simultaneousTCI-UpdateList2* up to two lists of cells for simultaneous TCI state activation, the UE applies the antenna port quasi co-location provided by *TCI-States* with same activated *tci-StateID* value to CORESETs with index in all configured DL BWPs of all configured cells in a list determined from a serving cell index provided by a MAC CE command  - an indication for a presence or absence of a transmission configuration indication (TCI) field for a DCI format, other than DCI format 1\_0, that schedules PDSCH receptions or indicates SPS PDSCH release or indicates SCell dormancy or indicates a request for a Type-3 HARQ-ACK codebook report without scheduling PDSCH and is transmitted by a PDCCH in CORESET , by *tci-PresentInDCI* or tci-PresentDCI-1-2.  < Unchanged part is omitted >  A UE that  - is configured for operation with carrier aggregation, and  - indicates support of search space sharing through *searchSpaceSharingCA-UL* or through *searchSpaceSharingCA-DL*, and  - has a PDCCH candidate with CCE aggregation level in CORESET for a first DCI format scheduling PUSCH transmission or UL grant Type 2 PUSCH release, other than DCI format 0\_0, or for a second DCI format scheduling PDSCH reception or SPS PDSCH release or indicating SCell dormancy or indicating a request for a Type-3 HARQ-ACK codebook report without scheduling PDSCH, other than DCI format 1\_0, having a first size and associated with serving cell ,  can receive a corresponding PDCCH through a PDCCH candidate with CCE aggregation level in CORESET for a first DCI format or for a second DCI format, respectively, having a second size and associated with serving cell if the first size and the second size are same.  < Unchanged part is omitted > |
| FL questions | The issue seems valid. Companies’ views are requested. |
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## NRU-HARQ4 (power control)

R1-2100332 (CATT) proposes corrections related to power control for enhanced Type-2 HARQ-ACK codebook and Type-3 HARQ-ACK codebook, as summarized below. Companies are invited to provide their views on the issues proposed in R1-2100332 in each table.

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| **HARQ4** | **Summary of proposals and companies’ views** |
| R1-2100332 | **Issue 1**: In current specification, the definitions of the number of HARQ-ACK bits for enhanced Type-2 HARQ-ACK codebook and Type-3 HARQ-ACK codebook are missing in Clause 7.2.1 when such HARQ-ACK codebook is configured. Note that for enhanced Type-2 HARQ-ACK codebook, the reference to Clause 9.1.3.1 for the number of HARQ-ACK information bits for Type-2 HARQ-ACK codebook could not cover enhanced Type-2 HARQ-ACK codebook since the number of HARQ-ACK information bits for enhanced Type-2 HARQ-ACK codebook is described in Clause 9.1.3.3.  Proposal 1: Add the definitions of the number of HARQ-ACK bits for enhanced Type-2 HARQ-ACK codebook and Type-3 HARQ-ACK codebook in Clause 7.2.1  **Issue 2**: In Clause 7.2.1, it is not clear that “otherwise” refers to the condition of “If the UE is not provided any of *pdsch-HARQ-ACK-Codebook*, *pdsch-HARQ-ACK-Codebook-r16*, or *pdsch-HARQ-ACK-OneShotFeedback*” or the condition of “if the UE includes a HARQ-ACK information bit in the PUCCH transmission”.  Proposal 2: Clarify the condition for the definition of the number of HARQ-ACK information bits when no HARQ-ACK codebook type is provided by replacing “If” by “When” in Clause 7.2.1  TP for TS38.213 clause 7.2.1  **Issue 3**: For Type-3 HARQ-ACK codebook, the number of UCI bits for PF2/3/4 and , which are used for PUCCH power control, are not defined in Clause 9.1.4.  Proposal: Add the definition of and in Clause 9.1.4 for the reference in Clause 7.2.1. To be more specific, similar as Type-1 HARQ-ACK codebook, is defined based on the pseudo-code and is defined based on the quantity of received TBs and CBGs within configured CCs and HARQ process(es).  **TPs for TS38.213 clause 9.1.4 and clause 7.2.1 are copied from R1-2100332** 7.2.1 UE behaviour If a UE transmits a PUCCH on active UL BWP  of carrier  in the primary cell  using PUCCH power control adjustment state with index , the UE determines the PUCCH transmission power  in PUCCH transmission occasion  as  [dBm]  where  -  is the UE configured maximum output power defined in [8-1, TS 38.101-1], [8-2, TS38.101-2] and [8-3, TS38.101-3] for carrier  of primary cell  in PUCCH transmission occasion  < Unchanged part is omitted >  -  is a PUCCH transmission power adjustment component on active UL BWP  of carrier  of primary cell  - For a PUCCH transmission using PUCCH format 0 or PUCCH format 1,  where  -  is a number of PUCCH format 0 symbols or PUCCH format 1 symbols for the PUCCH transmission as described in Clause 9.2.  -  for PUCCH format 0  -  for PUCCH format 1  -  for PUCCH format 0  -  for PUCCH format 1, where  is a number of UCI bits in PUCCH transmission occasion  - For a PUCCH transmission using PUCCH format 2 or PUCCH format 3 or PUCCH format 4 and for a number of UCI bits smaller than or equal to 11, , where  -  -  is a number of HARQ-ACK information bits that the UE determines as described in Clause 9.1.2.1 for Type-1 HARQ-ACK codebook, or as described in Clause 9.1.3.1 for Type-2 HARQ-ACK codebook when *pdsch-HARQ-ACK-Codebook = dynamic*, or as described in Clause 9.1.3.3 for Type-2 HARQ-ACK codebook when *pdsch-HARQ-ACK-Codebook-r16* is configured, or as described in Clause 9.1.4 for Type-3 HARQ-ACK codebook. When the UE is not provided any of *pdsch-HARQ-ACK-Codebook*, *pdsch-HARQ-ACK-Codebook-r16*, or *pdsch-HARQ-ACK-OneShotFeedback*,  if the UE includes a HARQ-ACK information bit in the PUCCH transmission; otherwise,  -  is a number of SR information bits that the UE determines as described in Clause 9.2.5.1  -  is a number of CSI information bits that the UE determines as described in Clause 9.2.5.2  -  is a number of resource elements determined as , where  is a number of subcarriers per resource block excluding subcarriers used for DM-RS transmission, and  is a number of symbols excluding symbols used for DM-RS transmission, as defined in Clause 9.2.5.2, for PUCCH transmission occasion on active UL BWP  of carrier  of primary cell  - For a PUCCH transmission using PUCCH format 2 or PUCCH format 3 or PUCCH format 4 and for a number of UCI bits larger than 11, , where  -  -  -  is a number of HARQ-ACK information bits that the UE determines as described in Clause 9.1.2.1 for Type-1 HARQ-ACK codebook, or as described in Clause 9.1.3.1 for Type-2 HARQ-ACK codebook when *pdsch-HARQ-ACK-Codebook = dynamic*, or as described in Clause 9.1.3.3 for Type-2 HARQ-ACK codebook when *pdsch-HARQ-ACK-Codebook-r16* is configured, or as described in Clause 9.1.4 for Type-3 HARQ-ACK codebook. When the UE is not provided any of *pdsch-HARQ-ACK-Codebook*, *pdsch-HARQ-ACK-Codebook-r16*, or *pdsch-HARQ-ACK-OneShotFeedback*,  if the UE includes a HARQ-ACK information bit in the PUCCH transmission; otherwise,  -  is a number of SR information bits that the UE determines as described in Clause 9.2.5.1  -  is a number of CSI information bits that the UE determines as described in Clause 9.2.5.2  -  is a number of CRC bits that the UE determines as described in Clause 9.2  -  is a number of resource elements that the UE determines as , where  is a number of subcarriers per resource block excluding subcarriers used for DM-RS transmission, and  is a number of symbols excluding symbols used for DM-RS transmission, as defined in Clause 9.2.5.2, for PUCCH transmission occasion on active UL BWP  of carrier  of primary cell.  < Unchanged part is omitted > 9.1.4 Type-3 HARQ-ACK codebook determination If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback*, the UE determines HARQ-ACK information bits, for a total number of HARQ-ACK information bits, of a Type-3 HARQ-ACK codebook according to the following procedure.  < Unchanged part is omitted >  If , the UE determines a number of HARQ-ACK information bits for obtaining a transmission power for a PUCCH, as described in Clause 7.2.1, as where  - is the number of transport blocks the UE receives in a HARQ process number for serving cell if *harq-ACK-SpatialBundlingPUCCH* is not used and *PDSCH-CodeBlockGroupTransmission* is not provided, or the number of transport blocks the UE receives in a HARQ process number for serving cell if *PDSCH-CodeBlockGroupTransmission* is provided and the PDSCH reception is scheduled by a DCI format that does not support CBG-based PDSCH receptions, or the number of PDSCH receptions if *harq-ACK-SpatialBundlingPUCCH* is provided and in a HARQ process number for serving cell and the UE reports corresponding HARQ-ACK information in the PUCCH.  - is the number of CBGs the UE receives in a HARQ process number for serving cell if *PDSCH-CodeBlockGroupTransmission* is provided and the PDSCH reception is scheduled by a DCI format that supports CBG-based PDSCH receptions and the UE reports corresponding HARQ-ACK information in the PUCCH. |
| FL questions | Here are questions on the addition of “when *pdsch-HARQ-ACK-Codebook = dynamic*, or as described in Clause 9.1.3.3 for Type-2 HARQ-ACK codebook when *pdsch-HARQ-ACK-Codebook-r16* is configured, or as described in Clause 9.1.4 for Type-3 HARQ-ACK codebook”.  As can be seen from the specification structure, Type-2 HARQ-ACK codebook covers both the cases of *pdsch-HARQ-ACK-Codebook = dynamic* and *pdsch-HARQ-ACK-Codebook = enhanced\_dynamic*. A simpler fix could be to change the referred section from 9.1.3.1 to 9.1.3 in order to also cover 9.1.3.2, or to write “in clause 9.1.3.1 or 9.1.3.2 for Type-2 HARQ-ACK codebook”.  Spec structure:  *9.1.3 Type-2 HARQ-ACK codebook determination*  *9.1.3.1 Type-2 HARQ-ACK codebook in physical uplink control channel*  *9.1.3.2 Type-2 HARQ-ACK codebook in physical uplink shared channel*  *9.1.3.3 Type-2 HARQ-ACK codebook grouping and HARQ-ACK retransmission*  For Type-3 HARQ-ACK codebook, the addition of the reference to section 9.1.4 covers two cases, where the number of UCI bits is larger than 11 or not larger than 11.  The case where UCI is smaller than or equal to 11 was proposed and discussed several times in past meetings but it was not agreed in previous discussions to define for Type-3 HARQ-ACK codebook for the case of less than or equal to 11 bits. Let’s see if companies’ views have changed.  The case where UCI is larger than 11 refers to , which seems already defined for Type-3 HARQ-ACK codebook in clause 9.1.4 by “the UE determines ”. The first sentence in the TP for clause 9.1.4 aims to clarify this.  The change of “if” to “when” doesn’t seem to be critical and at least in the FL’s view would not lead to a different reading or interpretation of the text.  **In summary, companies’ views are requested on the 4 questions below**:   * **Q1**: TP for TS38.213 clause 7.2.1: is the addition of a reference to section 9.1.3.3 (or changing reference from 9.1.3.1 to 9.1.3) necessary under the definition of  and ? * **Q2**: TP for TS38.213 clause 7.2.1: is the addition of reference to section 9.1.4 necessary under the definition of for the case where the number of UCI bits is larger than 11, along with the TP for clause 9.1.4 (If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback*, the UE determines HARQ-ACK information bits, for a total number of HARQ-ACK information bits, of a Type-3 HARQ-ACK codebook according to the following procedure.)? * **Q3**: TP for TS38.213 clause 7.2.1: is the addition of reference to section 9.1.4 necessary under the definition of for the case where the number of UCI bits is smaller than or equal 11, along with the TP for clause 9.1.4 to define when ? * **Q4**: TP for TS38.213 clause 7.2.1: is the change from “if” to “when” considered an essential correction? |
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## MultiPUSCH

R1-2007961 (ZTE), R1-2101651 (ASUSTeK) and R1-20004081 (VIVO) proposed corrections to multi-PUSCH specifications. The corrections are classified into 3 issues:

* Issue 1: possible ambiguity in the TDRA bitfield size in relation to *pusch-TimeDomainAllocationListForMultiPUSCH*
* Issue 2: possible reference to a wrong RRC parameter instead of *pusch-TimeDomainAllocationListForMultiPUSCH*
* Issue 3: possible ambiguous UE behaviour in case of simultaneous configuration of semi-static repetitions (with *pusch-AggregationFactor)* and *pusch-TimeDomainAllocationListForMultiPUSCH*

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| **Issue 1** | **Summary of proposals and companies’ views** |
| R1-2007961 ZTE | From the description of the DCI format 0\_1 in 38.212, we can see the bitwidth for TDRA bit fields in DCI format 0\_1 depends on the higher layer parameter *PUSCH-TimeDomainResourceAllocationList* configuration. And from the description of 38.331, the largest number of rows in the higher layer parameter *pusch-TimeDomainAllocationListForMultiPUSCH* configuration table is 16. Therefore the maximum bitwidth for TDRA bit fields in DCI format 0\_1 is 4 not 6 if higher layer parameter *pusch-TimeDomainAllocationListForMultiPUSCH* is configured, which is different from the case when the higher layer parameter *PUSCH-TimeDomainResourceAllocationList-ForDCIformat0\_1* configured with the largest number of entries 64 in the configured table.   |  | | --- | | ***pusch-TimeDomainAllocationListForMultiPUSCH***  Configuration of the time domain resource allocation (TDRA) table for multiple PUSCH (see TS 38.214 [19], clause 6.1.2). The network configures at most 16 rows in this TDRA table in *PUSCH-TimeDomainResourceAllocationList-r16* configured by this field. |   **TP for TS 38.212, Section 7.3.1.1.2**  < Start of text proposal for 38.212 [1]>  ================== Beginning of text proposal 2 =================== 7.3.1.1.2 Format 0\_1 DCI format 0\_1 is used for the scheduling of one or multiple PUSCH in one cell, or indicating CG downlink feedback information (CG-DFI) to a UE.  The following information is transmitted by means of the DCI format 0\_1 with CRC scrambled by C-RNTI or CS-RNTI or SP-CSI-RNTI or MCS-C-RNTI:  \*\*\* Unchanged text omitted \*\*\*  - Time domain resource assignment – 0, 1, 2, 3, 4, 5, or 6 bits  - If the higher layer parameter *PUSCH-TimeDomainResourceAllocationList-ForDCIformat0\_1* is not configured and if the higher layer parameter *pusch-TimeDomainAllocationListForMultiPUSCH* is not configured and if the higher layer parameter *pusch-TimeDomainAllocationList* is configured, 0, 1, 2, 3, or 4 bits as defined in Clause 6.1.2.1 of [6, TS38.214]. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *pusch-TimeDomainAllocationList*;  - If the higher layer parameter *PUSCH-TimeDomainResourceAllocationList-ForDCIformat0\_1* is configured, 0, 1, 2, 3, 4, 5 or 6 bits, or if the higher layer parameter *pusch-TimeDomainAllocationListForMultiPUSCH* is configured0, 1, 2, 3, or 4 bits, as defined in Clause 6.1.2.1 of [6, TS38.214]. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *PUSCH-TimeDomainResourceAllocationList-ForDCIformat0\_1* or *pusch-TimeDomainAllocationListForMultiPUSCH*;  - otherwise the bitwidth for this field is determined as bits, where *I* is the number of entries in the default table*.*  < End of text proposal 2> |
| FL questions | The original text did not seem wrong since it read “0, 1, 2, 3, 4, 5 or 6 bits”, so the exact number of bits still needs to be determined based on *PUSCH-TimeDomainResourceAllocationList-ForDCIformat0\_1* or *pusch-TimeDomainAllocationListForMultiPUSCH.* The current specification does not say that 6 bits is a supported value for *pusch-TimeDomainAllocationListForMultiPUSCH.* |
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| **Issue 2** | **Summary of proposals and companies’ views** |
| R1-2007961 ZTE | Another issue is that the parameter used in section 6.1.2.1 of 38.214 for PUSCH time domain allocation is not correct. As only one PUSCH can be allocated in each row of the TDRA table when *pusch-TimeDomainAllocationList* is configured and the TDRA table for *pusch-TimeDomainAllocationList* never contain arow indicating resource allocation for two to eight contiguous PUSCH. Only the parameter *pusch-TimeDomainAllocationListForMultiPUSCH-r16* which is introduced in NR-U can contains row indicating resource allocation for two to eight contiguous PUSCH. Therefore, in section 6.1.2.1 of 38.214, the parameter *pusch-TimeDomainAllocationList* should be replaced by *pusch-TimeDomainAllocationListForMultiPUSCH-r16.*  **TP for TS 38.214, Section 6.1.2.1**  < Start of text proposal for 38.214 [3]>  ================== Beginning of text proposal 3 =================== 6.1.2 Resource allocation6.1.2.1 Resource allocation in time domain \*\*\* Unchanged text omitted \*\*\*  If *pusch-TimeDomainAllocationListForMultiPUSCH-r16* in *pusch-Config* contains row indicating resource allocation for two to eight contiguous PUSCHs, *K2* indicates the slot where UE shall transmit the first PUSCH of the multiple PUSCHs. Each PUSCH has a separate SLIV and mapping type. The number of scheduled PUSCHs is signalled by the number of indicated valid SLIVs in the row of the *pusch-TimeDomainAllocationListForMultiPUSCH-r16* signalled in DCI format 0\_1.  < End of text proposal 3> |
| R1-2101651 ASUSTeK | **TP4 from R1-2101651 provides the same correction (without the extension marker):**  6.1.2.1 Resource allocation in time domain  <omitted>  If *pusch-TimeDomainAllocationListForMultiPUSCH* in *pusch-Config* contains row indicating resource allocation for two to eight contiguous PUSCHs, *K2* indicates the slot where UE shall transmit the first PUSCH of the multiple PUSCHs. Each PUSCH has a separate SLIV and mapping type. The number of scheduled PUSCHs is signalled by the number of indicated valid SLIVs in the row of the *pusch-TimeDomainAllocationListForMultiPUSCH* signalled in DCI format 0\_1.  **TP5 from R1-2101651 provides another (incompatible) correction for the same text:**  6.1.2.1 Resource allocation in time domain  <omitted>  If *PUSCH-TimeDomainResourceAllocationList* in *pusch-Config* contains row indicating resource allocation for two to eight contiguous PUSCHs, *K2* indicates the slot where UE shall transmit the first PUSCH of the multiple PUSCHs. Each PUSCH has a separate SLIV and mapping type. The number of scheduled PUSCHs is signalled by the number of indicated valid SLIVs in the row of the *PUSCH-TimeDomainResourceAllocationList* signalled in DCI format 0\_1. |
| R1-20004081 VIVO | **TP1 from R1-2100408 provides the same correction**  --------------------------------------------Start text proposal 1--------------------------------------------  6.1.2.1 Resource allocation in time domain  ……  If *~~pusch-TimeDomainAllocationList~~pusch-TimeDomainAllocationListForMultiPUSCH-r16* in *pusch-Config* contains row indicating resource allocation for two to eight contiguous PUSCHs, *K2* indicates the slot where UE shall transmit the first PUSCH of the multiple PUSCHs. Each PUSCH has a separate SLIV and mapping type. The number of scheduled PUSCHs is signalled by the number of indicated valid SLIVs in the row of the *pusch-TimeDomainAllocationList* signalled in DCI format 0\_1.  ……  ------------------------------------------------End text proposal 1---------------------------------------- |
| FL questions | The issue seems valid and a correction based on the TP from ZTE or TP4 from ASUSTeK or TP1 from VIVO may fix the issue. Companies’ views are requested. |
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| **Issue 3** | **Summary of proposals and companies’ views** |
| R1-2101651 ASUSTeK | For semi-static repetition number provided by *pusch-AggregationFactor*, current standard is missing about whether UE apply *pusch-AggregationFactor* for *pusch-TimeDomainAllocationListForMultiPUSCH*.  **Proposal 1: For resource allocation for two to eight PUSCHs provided in pusch-TimeDomainAllocationListForMultiPUSCH, repetition is not allowed. (Text Proposal 1 or Text Proposal 3)**  As for resource allocation for single PUSCH, according to RAN1 #99 agreement, since *pusch-TimeDomainAllocationListForMultiPUSCH* can support resource allocation for one PUSCH, resource allocation for single PUSCH with *pusch-AggregationFactor* can be either kept same as Rel-15 (repetition allowed) or not allowed for any repetition (same as the case for two to eight PUSCHs).  Option 1: For resource allocation for single PUSCH, repetition is allowed. Since repetition for single PUSCH has been allowed in Rel-15, it’s more flexible from gNB scheduling perspective to keep the same functionality. In this case, UE can set *K* = *pusch-AggregationFactor.*  Option 2: For resource allocation for single PUSCH, repetition is Not allowed. Since repetition for 2 to 8 PUSCHs is not allowed, it seems more aligned to also prohibit repetition for single PUSCH. Transmission robustness may not be vital important when *pusch-TimeDomainAllocationListForMultiPUSCH* is configured. In this case, UE would not expect to be configured with *pusch-AggregationFactor* and *pusch-TimeDomainAllocationListForMultiPUSCH* simultaneously.  **Proposal 2: For resource allocation for single PUSCH provided in *pusch-TimeDomainAllocationListForMultiPUSCH*, RAN1 discuss whether UE is allowed to apply *pusch-AggregationFactor*. (either Option 1 or Option 2)**  **Proposal 3a: If UE is allowed to apply *pusch-AggregationFactor* for resource allocation for single PUSCH in *pusch-TimeDomainAllocationListForMultiPUSCH*, UE considers *K*=** ***pusch-AggregationFactor* for DCI scheduling one PUSCH. (Text Proposal 2)**  **Proposal 3b: If UE is not allowed to apply pusch-AggregationFactor for resource allocation for single PUSCH in pusch-TimeDomainAllocationListForMultiPUSCH, UE does not expect to be configured with pusch-AggregationFactor and pusch-TimeDomainAllocationListForMultiPUSCH simultaneously (Text Proposal 3)**  **Text Proposal 1**  According text proposal for resource allocation in time domain is provided below.  **< Text Proposal 1 for 38.214 [1] >**   |  | | --- | | 6.1.2 Resource allocation  6.1.2.1 Resource allocation in time domain  <omitted>  If *pusch-TimeDomainAllocationList* in *pusch-Config* contains row indicating resource allocation for two to eight contiguous PUSCHs, *K2* indicates the slot where UE shall transmit the first PUSCH of the multiple PUSCHs, and in case *pusch-AggregationFactor >1*, considers *K*=1. Each PUSCH has a separate SLIV and mapping type. The number of scheduled PUSCHs is signalled by the number of indicated valid SLIVs in the row of the *pusch-TimeDomainAllocationList* signalled in DCI format 0\_1. |   **Text Proposal 2**  According text proposal for resource allocation in time domain is provided below.  **< Text Proposal 2 for 38.214 [1] >**   |  | | --- | | 6.1.2 Resource allocation  6.1.2.1 Resource allocation in time domain  <omitted>  For PUSCH repetition Type A, when transmitting PUSCH scheduled by DCI format 0\_1 or 0\_2 in PDCCH with CRC scrambled with C-RNTI, MCS-C-RNTI, or CS-RNTI with NDI=1, the number of repetitions *K* is determined as  - if *numberOfRepetitions-r16* is present in the resource allocation table, the number of repetitions K is equal to *numberOfRepetitions-r16*;  - elseif the UE is configured with *pusch-AggregationFactor* and the DCI schedules one PUSCH, the number of repetitions *K* is equal to *pusch-AggregationFactor*;  - otherwise *K=1*. |   **Text Proposal 3**  According text proposal for resource allocation in time domain is provided below.  **< Text Proposal 3 for 38.214 [1] >**   |  | | --- | | 6.1.2 Resource allocation  6.1.2.1 Resource allocation in time domain  <omitted>  For PUSCH repetition Type A, when transmitting PUSCH scheduled by DCI format 0\_1 or 0\_2 in PDCCH with CRC scrambled with C-RNTI, MCS-C-RNTI, or CS-RNTI with NDI=1, the number of repetitions *K* is determined as  - if *numberOfRepetitions* is present in the resource allocation table, the number of repetitions K is equal to *numberOfRepetitions*;  - elseif the UE is configured with *pusch-AggregationFactor*, the number of repetitions *K* is equal to *pusch-AggregationFactor*;  - otherwise *K=1*.  If a UE is configured with higher layer parameter *pusch-TimeDomainAllocationListForMultiPUSCH*, the UE does not expect to be configured with *pusch-AggregationFactor*. | |
| R1-20004081 VIVO | Proposal 4: It should be clarified whether PUSCH repetition is applied to multi-PUSCH scheduling or not in TS38.214.  Proposal 5: It should be clarified whether pusch-AggregationFactor and pusch-TimeDomainAllocationListForMultiPUSCH-r16 can be configured simultaneously, and the following options can be considered:   * Option 1: pusch-AggregationFactor and pusch-TimeDomainAllocationListForMultiPUSCH-r16 should not be configured simultaneously. * Option 2: pusch-AggregationFactor and pusch-TimeDomainAllocationListForMultiPUSCH-r16 can be configured simultaneously, and pusch-AggregationFactor is applied only to the entry(ies) indicating single PUSCH in pusch-TimeDomainAllocationListForMultiPUSCH-r16. |
| FL questions | The issue seems valid, the UE behaviour seems to be undefined when the UE is configured with *pusch-TimeDomainAllocationListForMultiPUSCH* and simultaneously with *pusch-AggregationFactor* providing value K > 1. Companies’ views are requested. |
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# Discussion for preparation phase

Based on the initial assessement in section 2 (see “FL questions”), the FL’s initial view is that:

* HARQ1, HARQ2, HARQ3-issues2&3, HARQ4 (Q3&Q4) may not require a correction because they have already been discussed in the past without consensus on the essentiality of a correction
* Multi-PUSCH issue 1 may not require a correction
* HARQ3-issue1 requires a clarification from the proponent
* HARQ3-issue4, HARQ3-issue5, HARQ4 (Q1, and potentially Q2), Multi-PUSCH issue 2 and issue 3 may require a correction

Companies’ views on the essentiality of the issues will be summarized in the table below (pre-filled for the submitted Tdocs), so companies are invited to add their views on the criticality/essentiality of the issues in the tables below (and if necessary provide more detailed background explanations in the tables provided for each issue in section 2):

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|  | HARQ1 (A9) | HARQ2 (B4) | HARQ3-issue1 | HARQ3- issues2&3 | HARQ3- issue4 | HARQ3- issue5 |
| ZTE |  | Y |  |  |  |  |
| OPPO |  | Y |  |  |  |  |
| VIVO | Y |  |  |  |  |  |
| Intel |  | Y |  |  |  |  |
| LG | Y | Y |  |  |  |  |
| ASUSTeK |  |  |  |  |  |  |
| CATT |  |  | Y | Y | Y | Y |
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|  | HARQ4  (answers may refer to Q1, Q2, Q3, Q4) | Multi-PUSCH  Issue 1 | Multi-PUSCH  Issue 2 | Multi-PUSCH  Issue 3 |
| ZTE |  | Y | Y |  |
| OPPO |  |  |  |  |
| VIVO |  |  | Y | Y |
| Intel |  |  |  |  |
| LG |  |  |  |  |
| ASUSTeK |  |  | Y | Y |
| CATT | Y for Q1, Q2, Q3, Q4 |  |  |  |
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# Recommendation from preparation phase

# References

[R1-2100071](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_104\Docs\R1-2100071.zip) Text proposals on type-3 HARQ-ACK codebook and multi-PUSCH scheduling ZTE, Sanechips

[R1-2100148](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_104\Docs\R1-2100148.zip) Text proposals on type-3 HARQ-ACK codebook OPPO

[R1-2100331](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_104\Docs\R1-2100331.zip) Correction on Type-3 HARQ-ACK codebook CATT

[R1-2100332](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_104\Docs\R1-2100332.zip) Correction on power control for HARQ-ACK transmission CATT

[R1-2100408](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_104\Docs\R1-2100408.zip) Maintenance on HARQ operation for NR-U vivo

[R1-2100628](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_104\Docs\R1-2100628.zip) Remaining issues on NR-U Intel Corporation

[R1-2100891](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_104\Docs\R1-2100891.zip) Remaining issues of HARQ procedure for NR-U LG Electronics

[R1-2101651](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_104\Docs\R1-2101651.zip) Remaining issues for multi PUSCHs in NR-U ASUSTeK