**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#2 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. The preparation phase has determined the need to discuss 5 issues with high priority and 3 issues with low priority.

Sections 2 and 3 provide the moderator’s proposals, with tables to collect companies’ comments. **Deadline for initial feedback is set to January 26 at UTC 4:59pm**, after which updated proposals will be provided as needed.

The corrections to be discussed at RAN1#104e are the following:

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| **High priority issues** | **Scope/description** |
| Multi-PUSCH issue 3 | Resolve ambiguous UE behaviour in case of simultaneous configuration of semi-static repetitions (with *pusch-AggregationFactor)* and *pusch-TimeDomainAllocationListForMultiPUSCH.* Review TPs for TS 38.214 |
| Multi-PUSCH issue 2 | Correct reference to a wrong RRC parameter *pusch-TimeDomainAllocationList* instead of *pusch-TimeDomainAllocationListForMultiPUSCH* in TS 38.214, Clause 6.1.2.1 |
| HARQ3 issue 1 | There may be several instances in the pseudo-code of TS38.213 clause 9.1.4 for a Type-3 HARQ-ACK codebook generation where the HARQ-ACK information is requested for a TB that was not scheduled (e.g. when $N\_{TB,c}^{DL}>1$ but a PDSCH has a single TB), for which a default value (e.g. NACK) would have to be defined. |
| HARQ3 issue 4 | Type-3 HARQ-ACK codebook report is missing when there is only one PUCCH resource set configured for HARQ-ACK transmission. Review TPs for TS 38.213, Clause 9.2.5.2. |
| HARQ3 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. Review TPs for TS 38.213, Clause 10.1. |

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| **Low priority issues** | **Scope/description** |
| 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. |
| 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. |
| Multi-PUSCH issue 1 | possible ambiguity in the TDRA bitfield size in relation to *pusch-TimeDomainAllocationListForMultiPUSCH* |

# High priority issues at RAN1#104e

## HARQ3 issue 1 (Type-3 CB)

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| HARQ3 issue 1R1-2100331  | 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 $N\_{TB,c}^{DL}>1$.Proposal: Add the UE behavior of HARQ-ACK generation for a PDSCH with one transport block if $N\_{TB,c}^{DL}>1$Proposed TP: If $N\_{TB,c}^{DL}>1$, 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. |
| Moderator summary | There may be several instances in the pseudo-code of TS38.213 clause 9.1.4 for a Type-3 HARQ-ACK codebook generation where the HARQ-ACK information is requested for a TB that was not scheduled (e.g. when $N\_{TB,c}^{DL}>1$ but a scheduled PDSCH has a single TB), for which a default value (e.g. NACK) would need to be defined.In the example from R1-2100331, the HARQ-ACK information for TB0 is not missing when $N\_{TB,c}^{DL}>1$ and the UE correctly received the scheduling DCI format, but the HARQ-ACK information for TB1 (which doesn’t exist because it wasn’t scheduled) is undefined although it is assigned by “ cid:image001.png@01D6F090.5A628050= HARQ-ACK information bit for CBG $g$ of TB $t$ for HARQ process number $h$ of serving cell $c$” in the pseudo-code. So it is proposed to set the default value to NACK for this case.The same correction might be needed for the case where CBG g was not scheduled for TB t.An simpler alternative to the TP proposed in R1-2100331 may be to fix directly in the pseudo-code with the addition of “if any; else cid:image001.png@01D6F090.5A628050= NACK ” as shown below:= HARQ-ACK information bit for CBG $g$ of TB $t$ for HARQ process number $h$ of serving cell $c$, if any; else cid:image001.png@01D6F090.5A628050= NACK |

Proposal 1:

* Specify NACK as the default value for any instance of “= HARQ-ACK information bit for CBG $g$ of TB $t$ for HARQ process number $h$ of serving cell $c$” if a value is not available because the UE didn’t receive a scheduling DCI for the corresponding TB or CBG on serving cell *c*.
* Example of possible TP:
	+ = HARQ-ACK information bit for CBG $g$ of TB $t$ for HARQ process number $h$ of serving cell $c$, if any; else = NACK

If the proposal above is agreeable, we will then proceed to discuss a TP.

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| **Company** | **Comments** |
| Moderator | Please provide your comments on proposal 1 |
| vivo | Fine with proposal 1. |
| Samsung | Both TP in R1-2100331 and proposal 1 can fix the problem.Slightly prefer TP in R1-2100331, which is aligned with description in 9.1.2 for type-1 codebook and 9.1.3.1 for type-2 codebook for the similar issue.  |
| ZTE | We are fine with proposal 1 |
| Intel | We are fine with proposal 1Proposal 1 can actually solve more issues. For example, in the quite beginning, one HARQ process is never used in DL transmission, how to set the HARQ-ACK for the process if Type3 codebook is triggered. Proposal 1 give the solution to set it to NACK.  |
| Lenovo, Motorola Mobility | We are fine with proposal 1. |
| LG | We are also fine with proposal 1.We share the same view with Intel, and considering the case configured with spatial bundling where ACK is assumed for the second TB, proposal 1 could be simplest and unified way to address this case of single TB scheduling. |

## HARQ3 issue 4 (Type-3 CB)

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| HARQ3 issue 4R1-2100331 | Type-3 HARQ-ACK codebook report is missing when there is only one PUCCH resource set configured for HARQ-ACK transmission. Review TPs for TS 38.213, 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 > |

Companies are invited to further comment on the TP proposed in R1-2100331 and OPPO’s comment from the preparation phase.

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| **Company** | **Comments** |
| Moderator | Please provide your comments |
| OPPO (comment from preparation phase) | Regarding HARQ3-issue4, in our understanding, if a UE is provided only one PUCCH resource set for transmission of HARQ-ACK information, the PUCCH resource set may only carry one or two HARQ-ACK information bits and it should not be used for Type-3 HARQ-ACK codebook. So we think discussion for this issue is needed. |
| vivo | The case where type 3 codebook with 1or 2 bits is very corner. The TP is not needed. |
| Samsung | Agree with other vivo and OPPO that 2 bit HARQ-ACK for type-3 HARQ-ACK codebook is very corner. But we're fine with the TP to make the spec complete.  |
| ZTE | We are fine with the proposal to make the spec complete. |
| Intel | As commented by other companies, the TP targets a corner case, hence is not needed |
| Lenovo, Motorola Mobility | Not needed. |
| LG | We also think the TP is not needed.Configuring only one PUCCH resource set for a UE means that the UE would have at most 2 bits for HARQ-ACK, thus Type-3 codebook would not be used in such case. |

## HARQ3 issue 5 (Type-3 CB)

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| HARQ3 issue 5R1-2100331 | 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. Review TPs for TS 38.213, Clause 10.1. |

Proposal 3: agree to TP3 with the “reason for change”, “summary of change” and “consequence if not approved” below.

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| ***Reason for change:*** | 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 |
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| ***Summary of change:*** | Add the DCI for indicating a request for a Type-3 HARQ-ACK codebook report without scheduling PDSCH in the paragraphs of CORESET configuration and search space sharing in Clause 10.1 |
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| ***Consequences if not approved:*** | Unclear UE behavior for TCI configuration and search space sharing for a DCI format indicating a request for a Type-3 HARQ-ACK codebook report without scheduling PDSCH |

================== Start of TP3 for TS 38.213 v16.4.0 ===================

**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 $p$, by *controlResourceSetId*  or by *controlResourceSetId-v1610*, where

- $0<p<12$ if *coresetPoolIndex* is not provided, or if a value of *coresetPoolIndex* is same for all CORESETs if *coresetPoolIndex* is provided;

- $0<p<16$ 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 $p$ 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 $p$, 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 $L$ in CORESET $p$ 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 $n\_{CI,2}$,

can receive a corresponding PDCCH through a PDCCH candidate with CCE aggregation level $L$ in CORESET $p$ for a first DCI format or for a second DCI format, respectively, having a second size and associated with serving cell $n\_{CI,1}$ if the first size and the second size are same.

< Unchanged part is omitted >

================== End of TP3 for TS 38.213 v16.4.0 ===================

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| **Company** | **Comments** |
| Moderator | Please provide your comments on proposal 3 |
| vivo | We are fine with proposal 3. |
| Samsung | We are fine with proposal 3. |
| ZTE | We are fine with proposal 3 |
| Intel | We are fine with proposal 3 |
| Lenovo, Motorola Mobility | We are fine with proposal 3 |
| LG | We are also fine with proposal 3 |

## HARQ4

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 7.2.1TP for TS38.213 clause 7.2.1**Issue 3**: For Type-3 HARQ-ACK codebook, the number of UCI bits for PF2/3/4 $O\_{ACK} $and $n\_{HARQ-ACK} $, which are used for PUCCH power control, are not defined in Clause 9.1.4.Proposal: Add the definition of $O\_{ACK} $and $n\_{HARQ-ACK} $in Clause 9.1.4 for the reference in Clause 7.2.1. To be more specific, similar as Type-1 HARQ-ACK codebook, $O\_{ACK}$ is defined based on the pseudo-code and $n\_{HARQ-ACK} $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 behaviourIf 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 $\tilde{o}\_{0}^{ACK},\tilde{o}\_{1}^{ACK},…,\tilde{o}\_{O\_{ACK}-1}^{ACK}$ HARQ-ACK information bits, for a total number of $O\_{ACK}$ HARQ-ACK information bits, of a Type-3 HARQ-ACK codebook according to the following procedure.< Unchanged part is omitted >If $O\_{ACK}+O\_{SR}+O\_{CSI} \leq 11$, the UE determines a number of HARQ-ACK information bits $n\_{HARQ-ACK}$ for obtaining a transmission power for a PUCCH, as described in Clause 7.2.1, as $n\_{HARQ-ACK}= \sum\_{c=0}^{N\_{cells}^{DL}-1}\sum\_{h}^{N\_{HARQ,c}^{DL}-1}N\_{c,h}^{received}+\sum\_{c=0}^{N\_{cells}^{DL}-1}\sum\_{h}^{N\_{HARQ,c}^{DL}-1}N\_{c,h}^{received,CBG}$ where - $\_{}^{}$ is the number of transport blocks the UE receives in a HARQ process number $h$ for serving cell $c$ 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 $h$ for serving cell $c$ 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 $h$ for serving cell $c$ and the UE reports corresponding HARQ-ACK information in the PUCCH.- $\_{}^{}$ is the number of CBGs the UE receives in a HARQ process number $h$ for serving cell $c$ 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 $n\_{HARQ-ACK}$ 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 $\tilde{o}\_{0}^{ACK},\tilde{o}\_{1}^{ACK},…,\tilde{o}\_{O\_{ACK}-1}^{ACK}$”. 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 $\tilde{o}\_{0}^{ACK},\tilde{o}\_{1}^{ACK},…,\tilde{o}\_{O\_{ACK}-1}^{ACK}$ HARQ-ACK information bits, for a total number of $O\_{ACK}$ 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 $n\_{HARQ-ACK}$ when $O\_{ACK}+O\_{SR}+O\_{CSI} \leq 11$?
* **Q4**: TP for TS38.213 clause 7.2.1: is the change from “if” to “when” considered an essential correction?
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Moderator’s summary of preparation phase: there didn’t appear to be a consensus on the criticality of the proposed corrections in the preparation phase, so companies are asked to provide more detailed comments on the proposals.

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| **Company** | **Comments** |
| Moderator | Please provide your detailed comments on Q1, Q2, Q3 and Q4, and any other comments on the TPs proposed in R1-2100332 as needed. |
| vivo | For Q1, we prefer that it is necessary for the addition.For Q2, we prefer that it is necessary for the addition.For Q3, we think it is unnecessary. This issue has been proposed and discussed for several times in the past, and no further discussion is needed in our opinion.For Q4, we think it is not essential, but the spec may be more clear when such correction is introduced. |
| Samsung  | For Q1~Q3, we think it is necessary. Q4 seems unnecessary. For Q3, though it was deprioritized due to limited time in previous meeting, we still shar the same view with CATT that adding the description for <11 bit case is necessary to make the spec complete and clear.  |
| ZTE | For Q1, although we are still uncertain abouth the necessity, we think moderator’s simple fix “changing reference from 9.1.3.1 to 9.1.3” could be acceptable.For Q2, we are fine with the TP.Q3 and Q4 are not necessary. |
| Intel | We are fine for the changes of Q1~Q3. Q4 is not necessary.  |
| Lenovo, Motorola Mobility | We are Ok with spec change for Q1 and Q2. Q3 and Q4 are not necessary.  |
| LG | We share the same view with ZTE.For Q1, the part “changing reference from 9.1.3.1 to 9.1.3” would be sufficient.For Q2, we are also fine with the TP.For Q3 and Q4, the TP is not necessary for the same reason with vivo. |

## MultiPUSCH issue2

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| Multi-PUSCH issue 2 | Correct reference to a wrong RRC parameter *pusch-TimeDomainAllocationList* instead of *pusch-TimeDomainAllocationListForMultiPUSCH* in TS 38.214, Clause 6.1.2.1 |

The proposals submitted to RAN1#104e are summarized below.

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| 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 allocation 6.1.2.1 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---------------------------------------- |

Proposal 4: Task the editor of TS38.214 to correct the RRC parameter name in clause 6.1.2.1 by replacing *pusch-TimeDomainAllocationList* with *pusch-TimeDomainAllocationListForMultiPUSCH* as in TP4 below*,* with the “reason for change”, “summary of change” and “consequence if not approved” below.

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| ***Reason for change:*** | Resource allocation in time domain for two to eight contiguous PUSCHs refers to an incorrect RRC parameter in pusch-Config.  |
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| ***Summary of change:*** | Replace *pusch-TimeDomainAllocationList* with *pusch-TimeDomainAllocationListForMultiPUSCH* as in Clause 6.1.2.1 |
|  |  |
| ***Consequences if not approved:*** | The UE cannot determine the number of scheduled PUSCHs from the RRC parameter *pusch-TimeDomainAllocationList* when two to eight contiguous PUSCHs are scheduled. |

================== Start of TP4 for TS 38.214 v16.4.0 ===================

**6.1.2.1 Resource allocation in time domain**

\*\*\* Unchanged text 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.

================== End of TP4 for TS 38.214 v16.4.0 ===================

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| **Company** | **Comments** |
| Moderator | Please provide your comments on proposal 4. |
| Vivo | We agree proposal 4 in principle. The “Consequences if not approved” may be changed to “The UE cannot be scheduled with two to eight contiguous PUSCHs when only the RRC parameter *pusch-TimeDomainAllocationList* is provided, because this parameter will never contains a row indicating resource allocation for two to eight configuous PUSCHs”. |
| Samsung | We’re fine with proposal 4 and “Consequences if not approved” updated by vivo.  |
| ZTE | We support the proposal and the TP 4. |
| Intel | We support the proposal and the TP 4. |
| Lenovo, Motorola Mobility | We support the proposal and the TP 4. |
| LG | We also support the proposal and the TP 4. |

## MultiPUSCH issue3

R1-2007961 (ZTE), R1-2101651 (ASUSTeK) and R1-20004081 (VIVO) proposed corrections to multi-PUSCH specifications due to possible ambiguous UE behaviour in case of simultaneous configuration of semi-static repetitions (with *pusch-AggregationFactor)* and *pusch-TimeDomainAllocationListForMultiPUSCH*.

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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] >**

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| 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] >**

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| 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] >**

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| 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.
 |
| Moderator summary | The UE behaviour seems to be undefined when the UE is configured with *pusch-TimeDomainAllocationListForMultiPUSCH* and simultaneously with *pusch-AggregationFactor* providing value K > 1. |

It needs to be clarified whether *pusch-AggregationFactor* and *pusch-TimeDomainAllocationListForMultiPUSCH-r16* can be configured simultaneously, and if so how *pusch-AggregationFactor* applies*.*

The two options below are considered for down-selection:

* 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
	+ pusch-AggregationFactor applies only if TDRA indicates an entry with a single PUSCH in pusch-TimeDomainAllocationListForMultiPUSCH-r16

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| **Company** | **Comments** |
| Moderator | Please provide your companies’ view on the support of option 1 or option 2, or another option (to be provided, if any) |
| vivo | Option 2 is slightly preferred, because it provides more flexibility for gNB’s configuration and scheduling. |
| Samsung  | Slightly prefer optin 1 for simplicity.  |
| ZTE | We support option 1 for simplicity. |
| Intel | Support Option 1 |
| Lenovo, Motorola Mobility | Option 1 is preferred for minor spec change. |
| LG | We also prefer Option 1. |

# Low priority issues at RAN1#104e

## HARQ1

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| 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. |

R1-2100891 (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.

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| **Company** | **Summary of proposals at RAN1#104e** |
| LGR1-2100891 | 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)
 |
| VivoR1-2100408 | 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. |

Companies are invited to further comment on the proposals from R1-2100891 and R1-2100408 in the table above.

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| **Company** | **Comments** |
| Moderator | Please provide your comments |
| vivo | We think it is better to clarify whether the NFI and DAI fields for the non-scheduled group in a DL DCI with q=0 is ignored by UE to aviod potential ambiguity between UE and gNB. The detailed analysis can be found in R1-2100408. |
| ZTE | We believe it could be left to UE implementation and no spec change is needed. |
| LG | We think UE behavior in case where a PDSCH group is not scheduled at UE side but T-DAI corresponding to the PDSCH group is received by the UE, need to be defined in terms of NFI signaling/assumption. This is because the above case is not quite different from (i.e., similar with) the case where UE only receives fallback DL DCI without non-fallback DCI containing the NFI, for which UE behavior was already defined. |

## HARQ2

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| 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 (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

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| **Company** | **Summary of proposals at RAN1#104e** |
| ZTER1-2100071 | 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 $N\_{HARQ-ACK,c}^{CBG/TB,max}>0$while $t<N\_{TB,c}^{DL}$if UE has reported HARQ-ACK information for TB $t$ for HARQ process number $h$ on serving cell $c$, and has not subsequently detected a DCI format scheduling a PDSCH reception, or received a SPS PDSCH, with TB $t$ for HARQ process number $h$ on serving cell $c$, or UE has not yet obtained HARQ-ACK information for a TB corresponding to a scheduled PDSCH receptionwhile $g<N\_{HARQ-ACK,c}^{CBG/TB,max}$$j=j+1$ $g=g+1$ end whileend ifif UE has obtained HARQ-ACK information for TB $t$ for HARQ process number $h$ on serving cell $c$ corresponding to a PDSCH reception and has not reported the HARQ-ACK information corresponding to the PDSCH receptionwhile $g<N\_{HARQ-ACK,c}^{CBG/TB,max}$= HARQ-ACK information bit for CBG $g$ of TB $t$ for HARQ process number $h$ of serving cell $c$$j=j+1$ $g=g+1$ end whileend if$g=0$ $t=t+1$ end whileelsewhile $t<N\_{TB,c}^{DL}$if UE has reported HARQ-ACK information for TB $t$ for HARQ process number $h$ on serving cell $c$ and has not subsequently detected a DCI format scheduling a PDSCH reception, or received a SPS PDSCH, with TB $t$ for HARQ process number $h$ on serving cell $c$, or UE has not yet obtained HARQ-ACK information for a TB corresponding to a scheduled PDSCH reception= NACK$j=j+1$ $t=t+1$ end if< End of text proposal 1> |
| OPPOR1-2100148 | 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>elseif $N\_{HARQ-ACK,c}^{CBG/TB,max}>0$while $t<N\_{TB,c}^{DL}$if UE has reported HARQ-ACK information for TB $t$ for HARQ process number $h$ on serving cell $c$, and has not subsequently detected a DCI format scheduling a PDSCH reception, or received a SPS PDSCH, with TB $t$ for HARQ process number $h$ on serving cell $c$while $g<N\_{HARQ-ACK,c}^{CBG/TB,max}$$j=j+1$ $g=g+1$ end whileend ifif UE has obtained HARQ-ACK information for TB $t$ for HARQ process number $h$ on serving cell $c$ corresponding to a PDSCH reception and has not reported the HARQ-ACK information corresponding to the PDSCH receptionwhile $g<N\_{HARQ-ACK,c}^{CBG/TB,max}$= HARQ-ACK information bit for CBG $g$ of TB $t$ for HARQ process number $h$ of serving cell $c$$j=j+1$ $g=g+1$ end whileelseif UE has not obtained HARQ-ACK information for TB $t$ for HARQ process number $h$ on serving cell $c$while $g<N\_{HARQ-ACK,c}^{CBG/TB,max}$$j=j+1$ $g=g+1$ end whileend if$g=0$ $t=t+1$ end whileelsewhile $t<N\_{TB,c}^{DL}$if UE has reported HARQ-ACK information for TB $t$ for HARQ process number $h$ on serving cell $c$ and has not subsequently detected a DCI format scheduling a PDSCH reception, or received a SPS PDSCH, with TB $t$ for HARQ process number $h$ on serving cell $c$= NACK$j=j+1$ $t=t+1$ end ifif UE has obtained HARQ-ACK information for TB $t$ for HARQ process number $h$ on serving cell $c$ corresponding to a PDSCH reception and has not reported the HARQ-ACK information corresponding to the PDSCH receptionif *harq-ACK-SpatialBundlingPUCCH* is not provided= HARQ-ACK information bit for TB $t$ for HARQ process $h$ of serving cell $c$else= binary AND operation of the HARQ-ACK information bits corresponding to first and second transport blocks for HARQ process $h$ of serving cell $c$. If the UE receives one transport block, the UE assumes ACK for the second transport blockend if$j=j+1$ $t=t+1$ elseif UE has not obtained HARQ-ACK information for TB $t$ for HARQ process number $h$ on serving cell $c$= NACK$j=j+1$ $t=t+1$ end ifend whileend if$t=0$ end if$h=h+1$ end while$h=0$ $c=c+1$ end while---------------------------------End of TP 1 38.213 V16.3.0 section 9.1.4----------------------------- |
| LGR1-2100891 | 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 |
| IntelR1-2100628 | 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 $t$ for HARQ process number $h$ on serving cell $c$, 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 $t$ for HARQ process number $h$ on serving cell $c$while $g<N\_{HARQ-ACK,c}^{CBG/TB,max}$$j=j+1$ $g=g+1$ end while~~end if~~else ~~if UE has obtained HARQ-ACK information for TB for HARQ process number on serving cell corresponding to a PDSCH reception and has not reported the HARQ-ACK information corresponding to the PDSCH reception~~while $g<N\_{HARQ-ACK,c}^{CBG/TB,max}$= HARQ-ACK information bit for CBG $g$ of TB $t$ for HARQ process number $h$ of serving cell $c$$j=j+1$ $g=g+1$ end whileend if…if UE has reported HARQ-ACK information for TB $t$ for HARQ process number $h$ on serving cell $c$ 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 $t$ for HARQ process number $h$ on serving cell $c$= NACK$j=j+1$ $t=t+1$ ~~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 $t$ for HARQ process $h$ of serving cell $c$$j=j+1$ $t=t+1$ end if |

Proposals are sorted into 4 options for Type3 HARQ-ACK codebook construction if a DCI is detected but the scheduled PDSCH cannot be decoded with sufficient processing time before the corresponding 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.
* Option 4: UE behaviour according to TS38.113 v16.4.0

From the submitted contributions, 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.

Companies are invited to further comment on the proposals in the table above and on the 4 options, including any necessary clarification for option 4 (what is the UE behaviour according to TS38.113 v16.4.0?).

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| **Company** | **Comments** |
| Moderator | Please provide your comments |
| vivo | We think continuous discussion on this issue is not desirable, because it has been extensively discussed in the past without any consensus. For the 4 options listed above, we prefer option 3, i.e. up to UE’s implementation, and gNB may ignore the reported HARQ-ACK value. |
| ZTE | Our preference is option 1. Becasue even if we allow UE to report ACK, the ACK is supposed to be an invalid value as defined in 38.214 section 5.3. We would not insist on the issue if the situation does not change ;) |
| Intel | Our preference is Option 2 for its best performance without UE implemention complexity. We commented in preparation phase on whether it is valid scheduling that a DCI is detected but the scheduled PDSCH cannot be decoded with sufficient processing time before the corresponding PUCCH. David clarified it is valid. Assuming this is the RAN1 understanding, we are OK to Option 3 too.  |
| Lenovo, Motorola Mobility | Option 1 is preferred. |
| LG | We also prefer Option 2 for the same reason with Intel.Regarding David’s clarification and Yingyang’s understanding, if it is valid gNB scheduling, it is reasonable that UE also needs to provide vaild HARQ-ACK feedback accordingly.The situation where UE may not provide vaild HARQ-ACK feedback even for vaild gNB scheduling seems unreasonable. |

## MultiPUSCH issue1

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| Multi-PUSCH issue 1 | Possible ambiguity in the TDRA bitfield size in relation to *pusch-TimeDomainAllocationListForMultiPUSCH* |
| 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.

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| ***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\_1DCI 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 $\left⌈log\_{2}(I)\right⌉ $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 $\left⌈log\_{2}(I)\right⌉ $bits, where *I* is the number of entries in the default table*.*< End of text proposal 2> |
| Moderator | 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.* |

Companies are invited to further comment on the TP proposed in R1-2007961 (copied in the table above).

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Moderator | Please provide your comments |
| vivo | We think the change is not needed, but we can accept it if most companies support the TP. |
| ZTE | We support the TP as the proposing company. The TP is helpful to avoid potential misunderstanding that “5 or 6 bits might be supported value for *pusch-TimeDomainAllocationListForMultiPUSCH*”. |
| Intel | We share similar view as vivo. The change is not necessary but can be OK if majority companies prefer the CR.  |
| Lenovo, Motorola Mobility | Not essential to us, but we can accept it. |
| LG | We also share similar view with other companies that the TP doesn’t seem to be essencial. |

# Summary

TBD

# References

[R1-2100071](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_104%5CDocs%5CR1-2100071.zip) Text proposals on type-3 HARQ-ACK codebook and multi-PUSCH scheduling ZTE, Sanechips

[R1-2100148](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_104%5CDocs%5CR1-2100148.zip) Text proposals on type-3 HARQ-ACK codebook OPPO

[R1-2100331](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_104%5CDocs%5CR1-2100331.zip) Correction on Type-3 HARQ-ACK codebook CATT

[R1-2100332](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_104%5CDocs%5CR1-2100332.zip) Correction on power control for HARQ-ACK transmission CATT

[R1-2100408](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_104%5CDocs%5CR1-2100408.zip) Maintenance on HARQ operation for NR-U vivo

[R1-2100628](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_104%5CDocs%5CR1-2100628.zip) Remaining issues on NR-U Intel Corporation

[R1-2100891](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_104%5CDocs%5CR1-2100891.zip) Remaining issues of HARQ procedure for NR-U LG Electronics

[R1-2101651](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_104%5CDocs%5CR1-2101651.zip) Remaining issues for multi PUSCHs in NR-U ASUSTeK