**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 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 .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. |
| 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 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 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 of TB for HARQ process number of serving cell ” 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 of TB for HARQ process number of serving cell , 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 of TB for HARQ process number of serving cell ” 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 of TB for HARQ process number of serving cell , 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 |
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## 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. |
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## 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 , 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 >

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

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| **Company** | **Comments** |
| Moderator | Please provide your comments on proposal 3 |
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## 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 |
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| ***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. |
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## 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*. |

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| 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.
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| 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) |
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# 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)
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| 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 |
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## 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 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 receptionwhile   end whileend ifif 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 receptionwhile = HARQ-ACK information bit for CBG of TB for HARQ process number of serving cell   end whileend if  end whileelsewhile 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> |
| 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 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 whileend ifif 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 receptionwhile = HARQ-ACK information bit for CBG of TB for HARQ process number of serving cell   end whileelseif UE has not obtained HARQ-ACK information for TB for HARQ process number on serving cell while   end whileend if  end whileelsewhile 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 ifif 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 receptionif *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 blockend if  elseif UE has not obtained HARQ-ACK information for TB for HARQ process number on serving cell = NACK  end ifend whileend if end if end while  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 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 whileend 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 |

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 |
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## 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 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> |
| 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).

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| **Company** | **Comments** |
| Moderator | Please provide your comments |
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# 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