**3GPP TSG RAN WG1 Meeting #103-e R1-200xxxx**

e-Meeting, October 26th – November 13th, 2020

**Agenda Item: 7.2.2**

**Source: Moderator (Huawei)**

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

**Document for: Discussion and Decision**

# Introduction

Corrections on NR-U HARQ have been submitted at RAN1#103 e-meeting. This first summary provides a list of submitted corrections and asks for companies’ views on the criticality of the proposed corrections.

Timeline:

* Preparation phase: October 19-23
* Technical discussion: October 26-29
* TP preparation: November 2-6

The corrections proposed at RAN1#103e are re-submissions or continuations of issues discussed in past meetings on enhanced type-2 HARQ-ACK codebook (A16 3 Tdocs, A9 1 Tdoc), type-3 HARQ-ACK codebook (B4 6 Tdocs, B14 1 Tdoc), out-of-order HARQ-ACK (C3 7 Tdocs, C4 1 Tdoc), and multi-PUSCH scheduling (1 Tdoc).

# Summary of corrections proposed at RAN1#103e

## Out-of-Order issue with HARQ-ACK retransmission (NRU-HARQ-OOO)

R1-2007609 (HW), R1-2007933 (Intel), R1-2007981 (Ericsson), R1-2008044 (LG), R1-2008128 (Samsung), R1-2008206 (Nokia) and R1-2008249 (OPPO) discussed the FFS point of the agreement made at RAN1#102e:

Agreement (RAN1#102e):

When a UE receives a second PDSCH (for DL SPS) after a first PDSCH, where the first PDSCH is not assigned an applicable K1 value in the corresponding first DCI format,

* the UE transmits HARQ-ACK for the first PDSCH:
  + if the UE detects a second DCI format in any PDCCH monitoring occasion after the first DCI format where the second DCI format assigns an applicable K1 value for the first PDSCH (as specified in TS38.213 section 9.1.3) that corresponds to HARQ-ACK timing no later than the HARQ-ACK timing assigned for the second PDSCH
* Otherwise, the UE does not multiplex the HARQ-ACK information for the first PDSCH in a PUCCH or PUSCH transmission, unless a HARQ-ACK information retransmission is requested later than the HARQ-ACK timing assigned for the second PDSCH.
* FFS: Which codebook type(s) can be used for the HARQ-ACK information retransmission

The views are summarized below for allowing a HARQ-ACK information retransmission request (that does not qualify as an out-of-order condition per RAN1#102e agreement):

* By eType2 or Type3 CB
  + Huawei, Hisilicon, Intel, Ericsson, OPPO
  + Samsung (in case of eType2 CB only if feedback for both groups is requested)
* By Type3 CB
  + Nokia, Nokia Shanghai Bell (FL: the proposed TP seems not aligned with RAN1#102e agreement)
  + LG
* By Type2 CB
  + OPPO (only when UE is also configured with Type 3 CB)

There were different views in the Tdocs on the need for a TP once the type(s) of codebook(s) is agreed for a HARQ-ACK retransmission. The first should anyway be to decide which codebook type(s) allow such retransmissions.

FL proposal: discuss at RAN1#103e

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| **Company** | **Summary of proposals** |
| Huawei  R1-2007609 | Observation 1: Any HARQ information transmission for a PDSCH initially scheduled with NNK1 value should be considered as a HARQ re-transmission by the network and by the UE.  Proposal 1: gBN can choose either Type3 codebook or enhanced Type2 codebook for requesting HARQ-ACK information retransmission of a first PDSCH (initially scheduled with NNK1 value earlier than a DL SPS PDSCH), where the request for HARQ-ACK information retransmission is received later than the HARQ-ACK timing assigned for the DL SPS PDSCH. |
| Intel  R1-2007933 | HACK-ACK transmission for PDSCH 1 after PUCCH1 should be considered as retransmission for the HARQ-ACK information. According to the above conclusion from last meeting, OOO checking doesn’t apply to the HARQ-ACK retransmission for PDSCH1.  Proposal 2: Both enhanced Type2 HARQ-ACK codebook and Type3 HARQ-ACK codebook are allowed for the HARQ-ACK retransmission of PDSCH1 after the timing of PUCCH1 for the SPS PDSCH. |
| Ericsson  R1-2007981 | The agreement should be applicable irrespective of the codebook type used for requesting the retransmission. Update the agreement by simply removing the FFS. The agreed behavior is aligned with what is already in the specification. Additionally, a conclusion was made last meeting about excluding retransmissions from the existing rel-15 OOO behavior. Therefore, no TP is needed. |
| LG  R1-2008044 | Proposal: One-shot Type-3 codebook can be used for the HARQ-ACK retransmission in potential OOO case caused by combination of NNK1 indication and SPS PDSCH.  If a UE receives a first DCI format that the UE detects in a first PDCCH monitoring occasion and includes a PDSCH-to-HARQ\_feedback timing indicator field providing an inapplicable value from *dl-DataToUL-ACK*,  - if the UE detects a second DCI format not including a One-shot HARQ-ACK request field with value 1 and a value of a PDSCH-to-HARQ\_feedback timing indicator field in the second DCI indicates a slot with the earliest one among PUCCH or PUSCH transmission(s) carrying HARQ-ACK corresponding to the PDSCH received after the first PDSCH reception that satisfies the timing conditions in Clause 9.2.5, the UE multiplexes the corresponding HARQ-ACK information in ~~a~~ the PUCCH or PUSCH transmission ~~in a slot that is indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in the second DCI format~~, where  - if the UE is not provided *pdsch-HARQ-ACK-Codebook = enhancedDynamic-r16*, the UE detects the second DCI format in any PDCCH monitoring occasion after the first one  - if the UE is provided *pdsch-HARQ-ACK-Codebook = enhancedDynamic-r16*, the UE detects the second DCI format in any PDCCH monitoring occasion after the first one, and the second DCI format indicates a HARQ-ACK information report for a same PDSCH group index as indicated by the first DCI format as described in Clause 9.1.3.3  - if the UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, the first DCI format does not indicate SPS PDSCH release or SCell dormancy, the UE detects the second DCI format in any PDCCH monitoring occasion after the first one, and the second DCI format includes a One-shot HARQ-ACK request field with value 1, the UE includes the HARQ-ACK information in a Type-3 HARQ-ACK codebook, as described in Clause 9.1.4.  - otherwise, the UE does not multiplex the corresponding HARQ-ACK information in a PUCCH or PUSCH transmission. |
| Samsung  R1-2008128 | Proposal: HARQ-ACK retransmission for a PDSCH with NNK1 for both type-3 codebook and enhanced type-2 codebook for both PDSCH groups is supported. To support efficient HARQ-ACK feedback for NR-U, it is proposed to update the previous agreement as below:  When a UE receives a second PDSCH (for DL SPS) after a first PDSCH, where the first PDSCH is not assigned an applicable K1 value in the corresponding first DCI format,   * the UE transmits HARQ-ACK for the first PDSCH:   + if the UE detects a second DCI format in any PDCCH monitoring occasion after the first DCI format where the second DCI format assigns an applicable K1 value for the first PDSCH (as specified in TS38.213 section 9.1.3) that corresponds to HARQ-ACK timing no later than the HARQ-ACK timing assigned for the second PDSCH * Otherwise, the UE does not multiplex the HARQ-ACK information for the first PDSCH in a PUCCH or PUSCH transmission, unless a HARQ-ACK information retransmission is requested by the second DCI which includes one-shot HARQ-ACK request field with value 1 or requests feedback for both PDSCH groups later than the HARQ-ACK timing assigned for the second PDSCH |
| Nokia  R1-2008206 | Proposal: At least TYPE-3 CB can be used for the HARQ-ACK information retransmission  9.1.3 Type-2 HARQ-ACK codebook determination  This clause applies if the UE is configured with *pdsch-HARQ-ACK-Codebook = dynamic* or with *pdsch-HARQ-ACK-Codebook = enhancedDynamic-r16*. Unless stated otherwise, a PDSCH-to-HARQ\_feedback timing indicator field provides an applicable value.  A UE does not expect to multiplex in a Type-2 HARQ-ACK codebook HARQ-ACK information that is in response to a detection of a DCI format that does not include a counter DAI field.  If a UE receives a first DCI format that the UE detects in a first PDCCH monitoring occasion and includes a PDSCH-to-HARQ\_feedback timing indicator field providing an inapplicable value from *dl-DataToUL-ACK*,  - if the UE detects a second DCI format, the UE multiplexes the corresponding HARQ-ACK information in a PUCCH or PUSCH transmission in a slot that is indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in the second DCI format, where  - if the UE is not provided *pdsch-HARQ-ACK-Codebook = enhancedDynamic-r16*, the UE detects the second DCI format in any PDCCH monitoring occasion after the first one  - if the UE is provided *pdsch-HARQ-ACK-Codebook = enhancedDynamic-r16*, the UE detects the second DCI format in any PDCCH monitoring occasion after the first one, and the second DCI format indicates a HARQ-ACK information report for a same PDSCH group index as indicated by the first DCI format as described in Clause 9.1.3.3  - if the UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, the first DCI format does not indicate SPS PDSCH release or SCell dormancy, the UE detects the second DCI format in any PDCCH monitoring occasion after the first one, and the second DCI format includes a One-shot HARQ-ACK request field with value 1, the UE includes the HARQ-ACK information in a Type-3 HARQ-ACK codebook, as described in Clause 9.1.4.  - and where the slot indicated by the value of the PDSCH-to-HARQ\_feedback timing indicator field in the second DCI format is no later than a slot assigned for HARQ-ACK information of a second PDSCH, if any, with CRC scrambled by a CS-RNTI and received after the PDSCH scheduled by the first DCI format. |
| OPPO  R1-2008249 | Proposal 1: When a UE receives a SPS PDSCH after a first PDSCH, where the first PDSCH is assigned with NNK1:   * When at least one of e-type 2 codebook and type 3 codebook is configured, a DCI assigning an applicable K1 value for the first PDSCH with type 2, e-type 2 or type 3 codebook, the UE will consider as the retransmission of the HARQ-ACK corresponding to the first PDSCH. * When only type 2 codebook is configured, if the UE does not receive a DCI assigning an applicable K1 value for the first PDSCH that corresponds to HARQ-ACK timing no later than HARQ-ACK timing assigned for the SPS PDSCH before t0, the UE can skip the processing of the first PDSCH or SPS PDSCH, where t0 is determined based on the starting of PUCCH assigned for the SPS PDSCH and PDSCH processing timeline. |

## Enhanced Type-2 HARQ-ACK codebook (NRU-HARQ-NFI-ULDAI)

R1-2007981 (Ericsson), R1-2008044 (LG) and R1-2008661 (Vivo) discussed the NFI and DAI values a UE should assume for reporting HARQ-ACK on PUSCH when the UE is provided with UL DAI (different than 4) for a PDSCH group that was not scheduled for the UE (issue A14 from previous meetings). Vivo also 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.

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

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| **Company** | **Summary of proposals** |
| Ericsson  R1-2007981 | Proposal 2: If a UE is scheduled a PUSCH transmission by DCI format 0\_1 having a DAI field value for a PDSCH group index ,and the UE has not detected any DCI format scheduling PDSCH receptions for the PDSCH group index, and the UE has not detected any DCI format with a request for HARQ-ACK information for the PDSCH group index, the UE generates HARQ-ACK information for the PDSCH group as described in Clause 9.1.3.1 by setting and, after the completion of the and loops for the pseudo-code for the HARQ-ACK codebook generation in Clause 9.1.3.1, setting . |
| LG  R1-2008044 | Proposal 1: For the case when a PDSCH group is not scheduled at UE side and the PDSCH group corresponds to the T-DAI in UL grant DCI, one of the following alternatives is adopted.   * Alt 1: NFI value for the PDSCH group is assumed to be non-toggled from the latest value.   + Payload size of the HARQ-ACK on PUSCH is determined by the indicated T-DAI itself without accumulating the HARQ-ACKs in the previous PUCCH occasion. * Alt 2: NFI (for the PDSCH group) is signaled via the UL DCI (as for DL DCI) |
| Vivo  R1-2008661 | 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.  Proposal 2: No assumption for NFI is needed for a UL DAI different than 4 for a PDSCH group that was not scheduled for the UE. |

## Type-3 HARQ-ACK codebook (NRU-HARQ-B4)

R1-2007933 (Intel), R1-2007961 (ZTE), R1-2007981 (Ericsson), R1-2008044 (LG), R1-2008249 (OPPO) and R1-2008661 (Vivo) discussed the FFS point on the agreement made at RAN1#100e:

* 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

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

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| **Company** | **Summary of proposals** |
| Vivo  (R1-2008661) | Proposal 6: How to report HARQ-ACK for a HARQ process with a TB scheduled without sufficient processing time is up to UE implementation. |
| ZTE  (R1-2007961) | UE shall report NACK for the cases where the UE has not yet obtained HARQ-ACK information for a TB corresponding to a scheduled PDSCH reception  < Start of text proposal for 38.213>  9.1.4 Type-3 HARQ-ACK codebook determination  \*\*\* Unchanged text omitted \*\*\*  if  while  if UE has reported HARQ-ACK information for TB for HARQ process number on serving cell , and has not subsequently detected a DCI format scheduling a PDSCH reception, or received a SPS PDSCH, with TB for HARQ process number on serving cell , or UE has not yet obtained HARQ-ACK information for a TB corresponding to a scheduled PDSCH reception  while        end while  end if  if UE has obtained HARQ-ACK information for TB for HARQ process number on serving cell corresponding to a PDSCH reception and has not reported the HARQ-ACK information corresponding to the PDSCH reception  while  = HARQ-ACK information bit for CBG of TB for HARQ process number of serving cell      end while  end if      end while  else  while  if UE has reported HARQ-ACK information for TB for HARQ process number on serving cell and has not subsequently detected a DCI format scheduling a PDSCH reception, or received a SPS PDSCH, with TB for HARQ process number on serving cell , or UE has not yet obtained HARQ-ACK information for a TB corresponding to a scheduled PDSCH reception  = NACK      end if  < End of text proposal 1> |
| OPPO  (R1-2008249) | Proposal 2: Adopt TP1 for the generation of type-3 HARQ-ACK codebook.   * If the UE has not obtained HARQ-ACK information for a given HARQ process, NACK should be feedback for the given HARQ process.   --------------------------------- Start of TP1 38.213 V16.3.0 section 9.1.4-----------------------------9.1.4 Type-3 HARQ-ACK codebook determination  <Unchanged parts are omitted>  else  if  while  if UE has reported HARQ-ACK information for TB for HARQ process number on serving cell , and has not subsequently detected a DCI format scheduling a PDSCH reception, or received a SPS PDSCH, with TB for HARQ process number on serving cell  while        end while  end if  if UE has obtained HARQ-ACK information for TB for HARQ process number on serving cell corresponding to a PDSCH reception and has not reported the HARQ-ACK information corresponding to the PDSCH reception  while  = HARQ-ACK information bit for CBG of TB for HARQ process number of serving cell      end while  elseif UE has not obtained HARQ-ACK information for TB for HARQ process number on serving cell  while        end while  end if      end while  else  while  if UE has reported HARQ-ACK information for TB for HARQ process number on serving cell and has not subsequently detected a DCI format scheduling a PDSCH reception, or received a SPS PDSCH, with TB for HARQ process number on serving cell  = NACK      end if  if UE has obtained HARQ-ACK information for TB for HARQ process number on serving cell corresponding to a PDSCH reception and has not reported the HARQ-ACK information corresponding to the PDSCH reception  if *harq-ACK-SpatialBundlingPUCCH* is not provided  = HARQ-ACK information bit for TB for HARQ process of serving cell  else  = binary AND operation of the HARQ-ACK information bits corresponding to first and second transport blocks for HARQ process of serving cell . If the UE receives one transport block, the UE assumes ACK for the second transport block  end if      elseif UE has not obtained HARQ-ACK information for TB for HARQ process number on serving cell  = NACK      end if  end while  end if    end if    end while      end while  ---------------------------------End of TP 1 38.213 V16.3.0 section 9.1.4----------------------------- |
| LG  (R1-2008044) | Proposal 2: For one-shot Type-3 HARQ-ACK codebook without NDI inclusion, following UE behaviour is to be specified for the cases where the UE has not yet obtained HARQ-ACK information for a TB corresponding to a scheduled PDSCH reception.  - HARQ-ACK is reset to NACK if the NDI value for the TB is toggled.  - HARQ-ACK is kept as previous report if the NDI value is not toggled |
| Intel  (R1-2007933) | For the case that DCI is detected but PDSCH is not decoded with sufficient processing time for one-shot feedback,  - Case 1: if the NDI in the latest detected DCI is NOT toggled, UE report actual HARQ-ACK for the HARQ process;  - Case 2: if the NDI in the latest detected DCI is toggled, UE reports NACK for the HARQ process  Text proposal for section 9.1.4 in 38.213-g10.  …  if UE has reported HARQ-ACK information for TB for HARQ process number on serving cell , and has not subsequently detected a DCI format scheduling a PDSCH reception with non-toggled NDI, or has not received a SPS PDSCH, with TB for HARQ process number on serving cell  while        end while  ~~end if~~  else ~~if UE has obtained HARQ-ACK information for TB for HARQ process number on serving cell corresponding to a PDSCH reception and has not reported the HARQ-ACK information corresponding to the PDSCH reception~~  while  = HARQ-ACK information bit for CBG of TB for HARQ process number of serving cell      end while  end if  …  if UE has reported HARQ-ACK information for TB for HARQ process number on serving cell and has not subsequently detected a DCI format scheduling a PDSCH reception with non-toggled NDI, or has not received a SPS PDSCH, with TB for HARQ process number on serving cell  = NACK      ~~end if~~  else ~~if UE has obtained HARQ-ACK information for TB for HARQ process number on serving cell corresponding to a PDSCH reception and has not reported the HARQ-ACK information corresponding to the PDSCH reception~~  = HARQ-ACK information bit for TB for HARQ process of serving cell      end if |
| Ericsson  R1-2007981 | To simplify the procedure in 38.213 section 9.1.4, and also include a default behavior where the UE reports NACK if valid feedback is not available. We propose the following TP  --------------------------------- Start of Text poposal 2 for TS 38.213 --------------------------------- 9.1.4 Type-3 HARQ-ACK codebook determination \*\*\* Unchanged text is 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~~  ~~while~~        ~~end while~~  ~~end if~~  while  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, and has not been scheduled for reception of another PDSCH corresponding to TB t for HARQ process number h on serving cell c since the previous transmission of HARQ-ACK information  ~~while~~  = HARQ-ACK information bit for CBG of TB for HARQ process number of serving cell  else    end if      end while  ~~end if~~      end while  else  while  ~~if UE has reported HARQ-ACK information for TB for HARQ process number on serving cell and has not subsequently detected a DCI format scheduling a PDSCH reception, or received a SPS PDSCH, with TB for HARQ process number on serving cell~~  ~~= NACK~~      ~~end if~~  if UE has obtained HARQ-ACK information for TB for HARQ process number on serving cell corresponding to a PDSCH reception and has not reported the HARQ-ACK information corresponding to the PDSCH reception, and has not been scheduled for reception of another PDSCH corresponding to TB t for HARQ process number h on serving cell c since the previous transmission of HARQ-ACK information  if *harq-ACK-SpatialBundlingPUCCH* is not provided  = HARQ-ACK information bit for TB for HARQ process of serving cell  else  = binary AND operation of the HARQ-ACK information bits corresponding to first and second transport blocks for HARQ process of serving cell . If the UE receives one transport block, the UE assumes ACK for the second transport block  end if  else    end if      ~~end if~~  end while  end if    end if  \*\*\* Unchanged text is omitted \*\*\*  --------------------------------- End of Text Proposal 2 for TS 38.213 -------------------------------- |

## Type-3 HARQ-ACK codebook (NRU-HARQ-B14)

R1-2008661 (Vivo) re-submitted the TP on Type-3 codebook with CBG-based HARQ. The exact same TP was discussed at RAN1#102e [R1-2006983] and was not pursued because there was no consensus that the issue is critical. At least two companies thought that there is no ambiguity in the specifications.

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

Proposals from R1-2008661:

*Proposal 3: For Type-3 codebook, CBG-based HARQ for a configured CC refers to CBG-based scheduling, transmission and HARQ-ACK feedback.*

*Proposal 4: For Type-3 codebook, when pdsch-HARQ-ACK-OneShotFeedbackCBG-r16 is provided for a PUCCH cell group, and maxCodeBlockGroupsPerTransportBlock is provided for a configured serving cell belonging to the PUCCH cell group, UE ignores spatial bundling related configuration, and reports CBG-level HARQ-ACK for each configured downlink codeword for the serving cell.*

*Adopt the following TP1 for TS38.213 v16.3.0.*

-------------------------------------------------------Start text proposal 1--------------------------------------------------------

9.1.4 Type-3 HARQ-ACK codebook determination

If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, the UE determines a Type-3 HARQ-ACK codebook according to the following procedure.

Set to the number of configured serving cells

Set to the value of *nrofHARQ-ProcessesForPDSCH* for serving cell , if provided; else, set

Set to the value of *maxNrofCodeWordsScheduledByDCI* for serving cell if *harq-ACK-SpatialBundlingPUCCH* is provided and , or if *harq-ACK-SpatialBundlingPUCCH* is not provided, or if *maxCodeBlockGroupsPerTransportBlock* is provided for serving cell and *pdsch-HARQ-ACK-OneShotFeedbackCBG-r16* is provided; else, set

Set to the number of HARQ-ACK information bits per TB for PDSCH receptions on serving cell as described in Clause 9.1.1 if *maxCodeBlockGroupsPerTransportBlock* is provided for serving cell and *pdsch-HARQ-ACK-OneShotFeedbackCBG-r16* is provided; else, set

Set if *pdsch-HARQ-ACK-OneShotFeedbackNDI-r16* is provided; else set

--------------------------------------------------------End text proposal 1--------------------------------------------------------

*Proposal 5: Adopt the TP1 for Rel-16 TS38.213.*

## Multi-PUSCH scheduling (NRU-Multi-PUSCH)

R1-2007961 (ZTE) discussed whether the field descriptions of DCI format 0\_1 correctly specify that the bitwidth of NDI, RV amd CBGTI fields depends on the configuration of the higher layer parameter *pusch-TimeDomainAllocationListForMultiPUSCH-r16*, and if configured the bitwidth depends on the maximum number of PUSCHs that can be scheduled (rather than the actual number of scheduled PUSCHs by the DCI format). ZTE also mentioned the alignment with the RRC parameter name in 38.331.

Example of current description for NDI field in TS38.212 (with parameter name alignment in editor’s CR R1-2008792):

- New data indicator – 1 bit if the number of scheduled PUSCH indicated by the Time domain resource assignment field is 1; otherwise 2, 3, 4, 5, 6, 7 or 8 bits determined based on the maximum number of schedulable PUSCH among all entries in the higher layer parameter *pusch-TimeDomainAllocationListForMultiPUSCH-r16*, where each bit corresponds to one scheduled PUSCH as defined in clause 6.1.4 in [6, TS 38.214].

Correction proposed in R1-2007961 for NDI field:

* New data indicator – 1 bit if the higher layer parameter *pusch-TimeDomainAllocationListForMultiPUSCH-r16* is not configured; or 1, 2, 3, 4, 5, 6, 7 or 8 bits if the higher layer parameter *pusch-TimeDomainAllocationListForMultiPUSCH-r16* is configured and the bitwidth for this field is determined based on the maximum number of schedulable PUSCH among all entries in the higher layer parameter *TimeDomainAllocationListForMultiPUSCH-r16*

FL analysis: the correction proposed in R1-2007961 is not provided on top of V16.3.0 of TS38.212. The RRC parameter name alignment is already handled by the proposed editor’s CR R1-2008792. It is the FL’s understanding that current field description already clearly specifies that the bitwidth depends only on the higher layer configuration.

FL proposal: no need for a correction

# Discussion for preparation phase

Based on the summary in section 2, the FL proposes to decide whether to discuss the following issues:

* **NRU-HARQ-OOO**: which codebook type(s) can be used for the HARQ-ACK information retransmission (FFS from RAN1#102e), and then if needed any TP.
* **NRU-HARQ-NFI-ULDAI**: 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 in PUSCH or PUCCH).
* **NRU-HARQ-B4**: 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
* **NRU-HARQ-B14**: whether there is any ambiguity in Type-3 codebook with CBG-based HARQ (proposals 3, 4, 5 in R1-2008661)
* **NRU-Multi-PUSCH**: whether there is any ambiguity in bitfield size wrt RRC parameter *pusch-TimeDomainAllocationListForMultiPUSCH-r16*

The FL recommends discussing at least issue NRU-HARQ-OOO. The second, third and fourth issues have been discussed in previous meetings and they were not prioritized as critical or essential issues. According to the FL’s understanding, there is no issue to address on multi-PUSCH scheduling except for RRC parameter name alignment.

# Decision of preparation phase

# References

[R1-2007609](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2007609.zip) Maintenance on HARQ-ACK enhancement Huawei, HiSilicon

[R1-2007933](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2007933.zip) Remaining issues on NR-U Intel Corporation

[R1-2007961](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2007961.zip) Text proposals on type-3 HARQ-ACK codebook and multi-PUSCH scheduling ZTE, Sanechips

[R1-2007981](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2007981.zip) HARQ Corrections Ericsson

[R1-2008044](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008044.zip) Remaining issues of HARQ procedure for NR-U LG Electronics

[R1-2008128](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008128.zip) Remaining issues on HARQ Samsung

[R1-2008206](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008206.zip) Remaining issues on NR-U HARQ and Initial Access Procedures Nokia, Nokia Shanghai Bell

[R1-2008249](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008249.zip) Discussion on the remaining issues of HARQ enhancements OPPO

[R1-2008661](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008661.zip) Remaining issues on HARQ operation for NR-U vivo