**3GPP TSG RAN WG1 Meeting #101-e                     R1-200xxxx**

**e-Meeting, May 25th – June 5th, 2020**

**Agenda Item: 7.2.2.2.3**

**Source: Moderator (Huawei)**

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

**Document for: Discussion and Decision**

# Introduction

Corrections to Rel-16 specifications have been submitted at RAN1#101 e-meeting on NR-U HARQ. There are also corrections proposed in relation to URLLC enhancements configuration with unlicensed operation including for multi-PUSCH scheduling. This first summary provides a list of the corrections proposed at RAN1#101-e and a revised classification of the submitted proposals reusing and continuing the numbering from RAN1#100-e and RAN1#100b-e.

Timeline:

* **Preparation phase: May 20-22**
* Technical discussion: May 25-29
* TP preparation: June 1-5

The corrections proposed at RAN1#101 e-meeting are the following:

* **A (enhanced type 2 HARQ codebook): see section 2**
  + Postponed and remaining issues: A5, A7, A16
  + Additional issues: A17, A18, A19, A20
  + Already resolved at RAN1#100/100b-e: A1, A3, A4, A10, A2, A9, A8, A11
* **B (type 3 HARQ codebook): see section 3**
  + Postponed and remaining issues: B1 (FFS on CS-RNTI), B4 (one FFS), B6, B8
  + Additional issues: B11, B12
  + Already resolved at RAN1#100/100b-e: B3, B4, B1, B9, B10
* **C (issues related to NNK1): see section 4**
  + C1 (leftover from A11)
  + C2 (NNK1 with DCI format 1\_2)
* **D (multi-PUSCH configurations of URLLC and NR-U): see section 5 and annex D1**
  + D1: Multi-PUSCH scheduling (LS R1-2004665) and possible response LS to RAN2. This issue may have its own separate email discussion in agenda 5.

Annex 6 contains a sub-section per issue including a more detailed summary of the proposals from the contributions, in order to help the understanding and discussion in preparation/prioritization phase 1. **Companies are requested to provide their feedback using the Table in section 5 on the criticality, essentiality and priority of the issues in the preparation phase**.

Tentative email discussions proposed for RAN1#101-e are shown in the table below. Priority was given to issues identified by multiple companies (except B4 where consensus seems unlikely), including essential corrections identified in earlier meetings (e.g. A5). Some of the issues in the table below are marked with TBD, so companies’ views are requested on the criticality of these issues, some of which are new.

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| **Tentative email discussions at May RAN1#101-e meeting** | |
| Email discussion #1 | **Corrections on Type-2 enhanced HARQ-ACK codebook**   * Issue A5: nHARQ-ACK definition for power control with enhanced dynamic codebook is missing * TBD: Issue A7: How is T-DAI interpreted in DCI 1\_1 for the non-scheduled group when two sub-codebooks (for TB and CBG) are configured? * TBD: Issue A16: What NFI value should a UE assume when the UE is provided with UL DAI (different than 4) for a PDSCH group that was not scheduled for the UE? * TBD: Issue A17: Out-of-Order issue for NNK1 (not limited to enhanced dynamic codebook) * TBD: Issue A18: Handling of DCI format 1\_0 indicating a SPS PDSCH release in enhanced dynamic HARQ-ACK codebook |
| Email discussion #2 | **Corrections on Type-3 HARQ-ACK codebook**   * Issue B2: Corrections in handling of spatial bundling * Issue B6: Handling of collisions between SPS-release ACK and Type-3 HARQ-ACK codebook feedback * Issue B1 (leftover) FFS on triggering Type-3 HARQ-ACK codebook feedback with a DCI that does not schedule a PDSCH and with CRS scrambled by CS-RNTI * TBD: Issue B11: Timeline for UCI Piggybacked on PUSCH for Type-3 HARQ-ACK codebook * TBD: Issue B12: Processing time for cancelling PUCCH indicated by another DCI |
| Email discussion #3 | **Corrections related to NNK1 value**   * Issue C1 (leftover):   + FFS: DCI format 1\_1 should not simultaneously indicate a NNK1 value and indicate Scell dormancy   + FFS: DCI format 1\_1 should not simultaneously indicate a NNK1 value and indicate SPS release * Issue C2: DCI formats 0\_2/1\_2 usage with PUCCH priority in case of NNK1 value signaled in PDSCH-to-HARQ\_feedback timing indicator |

# Corrections on enhanced dynamic HARQ-ACK codebook

Corrections proposed on enhanced dynamic HARQ codebook

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| Issue | Description | Tdoc |
| A5 | TS38.213 clause 9.1.3.3: nHARQ-ACK definition for power control with enhanced dynamic codebook is missing | R1-2003372  R1-2003845  R1-2003862  R1-2004087  R1-2004257  R1-2004445 |
| A7 | TS38.213 clause 9.1.3.3: How is T-DAI interpreted in DCI 1\_1 for the non-scheduled group when two sub-codebooks (for TB and CBG) are configured? | R1-2003372  R1-2003514  R1-2003862  R1-2004015  R1-2004257  R1-2004445 |
| A16 | What NFI value should a UE assume when the UE is provided with UL DAI (different than 4) for a PDSCH group that was not scheduled for the UE? | R1-2003514  R1-2003845  R1-2004529  R1-2004257 |
| A17 | Out-of-Order issue for NNK1 | R1-2004445 |
| A18 | Handling of DCI format 1\_0 indicating a SPS PDSCH release in enhanced dynamic HARQ-ACK codebook | R1-2003658 |
| A19 | Proposal 1: HARQ-ACK information bits for PDSCH group 1 is placed in the last N bit positions and HARQ-ACK information bits for PDSCH group 0 is placed in the first (11-N) bit positions when RM coding is used and T-DAI for PDSCH group 1 is included in DCI scheduling PDSCH in PDSCH group 0. | R1-2003823 |
| A20 | Proposal 2: If a PDSCH for a given HARQ process is received, the UE skips another PDSCH for a given HARQ process until after the end of the successful transmission of HARQ-ACK for that HARQ process. | R1-2004087 |

# Corrections on Type-3 HARQ-ACK codebook

Corrections proposed on Type-3 HARQ-ACK codebook

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| Issue | Description | Tdoc |
| B1 | FFS on triggering Type-3 HARQ-ACK codebook feedback with a DCI that does not schedule a PDSCH and with CRS scrambled by CS-RNTI | R1-2003514  R1-2004015  R1-2004257  R1-2004325 |
| B2 | Corrections in handling of spatial bundling for Type-3 HARQ-ACK codebook | R1-2003372  R1-2003452  R1-2003823  R1-2003845  R1-2004015  R1-2004087  R1-2004257 |
| B4 (FFS) | Issue B4 was resolved at RAN1#100e [1]  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 | R1-2003372  R1-2003452  R1-2003730  R1-2003845  R1-2004015  R1-2004087  R1-2004257 |
| B5 | nHARQ-ACK definition for power control with type-3 codebook is missing | R1-2003862 |
| B6 | Handling of collisions between SPS-release Ack and type-3 HARQ-ACK codebook feedback, potential inclusion of a SPS release HARQ-ACK in Type 3 HARQ-ACK codebook (not currently specified) | R1-2003372  R1-2003452  R1-2003514  R1-2003730  R1-2003823  R1-2003845  R1-2003862  R1-2004087  R1-2004257  R1-2004445 |
| B8 | If all the DCIs requesting one-shot feedback are missed, then UE and gNB are not aligned in the slot where the UE is supposed to report the type-3 codebook.  Case 1: if a collision with a PUCCH occasion for type2 (or type1) codebook happens, instead of reporting type3 codebook (as agreed) the UE will report type2 (or type1) codebook, resulting in mismatch with gNB’s expectation. In case of piggyback on PUSCH, this results in UL-SCH rate-matching issue.  Case 2: if there is no collision with a PUCCH occasion for type2 (or type1) codebook, if no PUSCH is transmitted in that slot then gNB does not receive any PUCCH, otherwise if a PUSCH is transmitted for reporting type2 (or type1) codebook then this results in UL-SCH rate-matching issue. | R1-2004257 |
| B11 | Timeline for UCI Piggybacked on PUSCH for Type-3 HARQ-ACK codebook  A UE does not expect to detect a DCI format scheduling a PDSCH reception or a SPS PDSCH release or a DCI format including a One-shot HARQ-ACK request field with value 1 and indicating a resource for a PUCCH transmission with corresponding HARQ-ACK information in a slot if the UE previously detects a DCI format scheduling a PUSCH transmission in the slot and if the UE multiplexes HARQ-ACK information in the PUSCH transmission. | R1-2004087 |
| B12 | Processing time for cancelling PUCCH indicated by another DCI  Proposal 1: The processing time requirement is set as a first value if Type-3 HARQ-ACK codebook in a first PUCCH is triggered by a first DCI format. In a case that a second DCI format indicates a second PUCCH which overlaps with the first PUCCH (and the first PUCCH is cancelled), the processing time requirement is set as a second value from the first DCI format to the second PUCCH. | R1-2004325 |
| B13 | Proposal 6: When a DCI format 1\_1 triggers one-shot feedback without scheduling PDSCH, a chosen set of unused fields in this DCI format is reinterpreted to assist one-shot HARQ-ACK reporting and control/reduce the codebook size. | R1-2003372 |

# Corrections related to NNK1 value

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| Issue | Description | Tdoc |
| C1 | SPS with enhanced dynamic codebook  - FFS: DCI format 1\_1 should not simultaneously indicate a NNK1 value and indicate Scell dormancy  - FFS: DCI format 1\_1 should not simultaneously indicate a NNK1 value and indicate SPS release | R1-2003452  R1-2003514  R1-2004015  R1-2004257 |
| C2 | DCI formats 0\_2/1\_2 usage with PUCCH priority in case of NNK1 value signaled in PDSCH-to-HARQ\_feedback timing indicator | R1-2003658  R1-2003845  R1-2004257 |

# Multi-PUSCH configurations of URLLC and NR-U

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| Issue | Description | Tdoc |
| D1 | Multi-PUSCH scheduling (LS R1-2004665) | R1-2003845 |

**Extract from R1-2004665(R2-2004271) LS on Conflicting configurations:**

RAN2 would like to know whether the following Rel-16 features can be freely configured together or what the restrictions to be captured are:

**4)** **PUSCH time domain resource allocation**

For **URLLC,** a new Rel-16 IE, PUSCH-TimeDomainResourceAllocationNew-r16 (name will have to be changed to avoid "New"), was defined which includes the parameters of PUSCH-TimeDomainResourceAllocation plus startSymbol, length and numberOfRepetitions. In addition, mappingType and startSymbolAndLength, which were mandatory in the Rel-15 IE PUSCH-TimeDomainResourceAllocationList, are optional in the Rel-16 IE.

For **NR-U**, a new Rel-16 IE, PUSCH-TimeDomainResourceAllocation (name will have to be changed as well), was defined (in this meeting, so not in 38.331 v 16.0.0) which includes multiplePUSCH-Allocations where each allocation is defined by mappingType and startSymbolAndLength.

The new URLLC Rel-16 IE is used in PUSCH-Config for pusch-TimeDomainAllocationListForDCI-Format0-2-r16 and pusch-TimeDomainAllocationListForDCI-Format0-1-r16.

The Rel-15 version PUSCH-TimeDomainResourceAllocationList is used for pusch-TimeDomainAllocationList in PUSCH-Config and pusch-TimeDomainAllocationList in PUSCH-ConfigCommon.

**Q4-1)** Can the multiplePUSCH-Allocations (introduced for NR-U) and startSymbol, length and numberOfRepetitions (introduced for URLLC) be configured in the same PUSCH time domain resource allocation table, used for one of the 2 above underlined fields?

**Q4-2)** Can the multiplePUSCH-Allocations (introduced for NR-U) be used for one of the 2 above underlined fields while startSymbol, length and numberOfRepetitions (introduced for URLLC) are used in another of the above underlined fields?

In Q4-3 and Q4-4, if the answer is "yes", please indicate all the associated restrictions if any.

For background, PUSCH-TimeDomainResourceAllocationListNew IE in TS38.331V16.0.0:

-- ASN1START

-- TAG-PUSCH-TIMEDOMAINRESOURCEALLOCATIONLISTNEW-START

PUSCH-TimeDomainResourceAllocationListNew-r16 ::= SEQUENCE (SIZE(1..maxNrofUL-Allocations-r16)) OF PUSCH-TimeDomainResourceAllocationNew-r16

PUSCH-TimeDomainResourceAllocationNew-r16 ::= SEQUENCE {

k2-r16 INTEGER (0..32) OPTIONAL, -- Need S

mappingType-r16 ENUMERATED {typeA, typeB} OPTIONAL, -- Cond RepTypeA

startSymbolAndLength-r16 INTEGER (0..127) OPTIONAL, -- Cond RepTypeA

startSymbol-r16 INTEGER (0..13) OPTIONAL, -- Cond RepTypeB

length-r16 INTEGER (1..14) OPTIONAL, -- Cond RepTypeB

numberOfRepetitions-r16 ENUMERATED {n1, n2, n4, n7, n12, n16},

...

}

-- TAG-PUSCH-TIMEDOMAINRESOURCEALLOCATIONLISTNEW-STOP

-- ASN1STOP

FL analysis: response to RAN2 is needed. Note that draft LS responses are provided in R1-2004428 and R1-2004627 is also submitted to agenda 5.

Proposal: discuss at RAN1#101-e. FFS to discuss under NRU HARQ email discussion or under an LS email discussion

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| **Company** | **Summary of proposals** |
| Ericsson  (R1-2003845) | Proposal 9: Reply with an LS to RAN2 indicating that a common IE to configure multi-PUSCH and the rel-16 repetition time allocation is preferred by RAN1. In rel-16, time resource assignment cannot indicate multiple PUSCHs and multiple repetition per PUSCH simultaneously. |
| Sharp  (R1-2004325) | It is a bit ambiguous which TDRA table the DCI format 0\_1 apply when multiple PUSCH scheduling is configured to the UE.  In the last meeting in RAN2 [2], it is agreed that the configuration on the multi-PUSCH scheduling has a separate IE *pusch-TimeDomainAllocationList-r16* from *pusch-TimeDomainAllocationList* for Rel-15 TDRA table. That’s why the clarification is necessary in TS38.214 to include this.  **Text proposal#2**  --------- beginning of text proposal for TS 38.214 6.1.2.1.1 Determination of the resource allocation table to be used for PUSCH -------- Unchanged contents are omitted  **Table 6.1.2.1.1-1A: Applicable PUSCH time domain resource allocation for DCI format 0\_1 in UE specific search space scrambled with C-RNTI, MCS-C-RNTI, CS-RNTI or SP-CSI-RNTI**   |  |  |  |  | | --- | --- | --- | --- | | ***pusch-ConfigCommon* includes *pusch-TimeDomainAllocationList*** | ***pusch-Config* includes *pusch-TimeDomainAllocationList*** | ***pusch-Config* includes *pusch-TimeDomainAllocationList* *-ForDCIformat0\_1* or *pusch-TimeDomainAllocationList-r16*** | **PUSCH time domain resource allocation to apply** | | No | No | No | Default A | | Yes | No | No | *pusch-TimeDomainAllocationList* provided in *pusch-ConfigCommon* | | No/Yes | Yes | No | *pusch-TimeDomainAllocationList* provided in *pusch-Config* | | No/Yes | No/Yes | Yes | *pusch-TimeDomainAllocationList-ForDCIformat0\_1*or *pusch-TimeDomainAllocationList-r16* provided in *pusch-Config* |   -------- Unchanged contents are omitted  --------- end of text proposal  **Text proposal#2**  --------- beginning of text proposal for TS 38.212 7.3.1.1.2 Format 0\_1 -------- Unchanged contents are omitted  - Time domain resource assignment – 0, 1, 2, 3, 4, 5, or 6 bits  - If neither of the higher layer parameters *PUSCH-TimeDomainResourceAllocationList-ForDCIformat0\_1* nor *pusch-TimeDomainAllocationList-r16* is 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 either of the higher layer parameters *PUSCH-TimeDomainResourceAllocationList-ForDCIformat0\_1* or *pusch-TimeDomainAllocationList-r16* is configured, 0, 1, 2, 3, 4, 5 or 6 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-TimeDomainAllocationList-r16* or *pusch-TimeDomainAllocationList-r16*;  - otherwise the bitwidth for this field is determined as bits, where *I* is the number of entries in the default table*.*  -------- Unchanged contents are omitted  --------- end of text proposal |
| Nokia  (R1-2004257) | The gNB controls the PDSCH grouping, HARQ-ACK retransmission, and reliable determination of enhanced Type 2 CB through a set of DCI fields specific for enhanced Type 2 CB. These cannot be configured for DCI format 1\_2 without late changes to RRC. UE behavior without these DCI fields has been defined for fallback DCI format 1\_0, but at price of considerable limitations. Such limitations are not attractive for a non-fallback DCI format 1\_2 introduced as URLLC enhancement. We see that enhanced Type 2 CB operation with DCI format 1\_2 should be reliable and flexible, without artificial limitations on configurability. Hence, we see that determination of enhanced Type 2 CB operation with DCI format 1\_2 should be postponed to a following NR release. Correspondingly, it should be clarified that Rel.16 enhanced Type 2 CB may operate only with DCI format 1\_0 and DCI format 1\_1.  **Proposal 3:** *It is concluded/clarified that Rel.16 enhanced Type 2 CB shall not be configured together with DCI format 1\_2 and DCI format 0\_2.*   |  | | --- | | **TP for TS38.213:** 9.1.3.3 Type-2 HARQ-ACK codebook grouping and HARQ-ACK retransmission <unchanged text omitted >  For PUCCH transmission occasion , the UE determines a PUCCH or a PUSCH transmission to multiplex the HARQ-ACK information according to the procedures in Clause 9.2.5.  If a UE is provided *pdsch-HARQ-ACK-Codebook = enhancedDynamic-r16*, the UE does not expect to detect DCI format 1\_2 and DCI format 0\_2.  <unchanged text omitted > | |
| ZTE  (R1-2003452) | Compatibility of NR-U HARQ design and R16 URLLC enhancements related issues should be discussed in Rel-17. |

# Companies’ view on RAN1#101-e email discussions

Companies are invited to fill-in the table below with their views on the criticality/essentiality of the issues.

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| **Issue** | **Description** | **Critical/essential** | **Non-critical/non-essential** |
| A5 | TS38.213 clause 9.1.3.3: nHARQ-ACK definition for power control with enhanced dynamic codebook is missing | QC, MTK, Sharp, Nokia, NSB, Intel, ZTE, Samsung, Lenovo, Motorola Mobility, vivo, LG |  |
| A7 | TS38.213 clause 9.1.3.3: How is T-DAI interpreted in DCI 1\_1 for the non-scheduled group when two sub-codebooks (for TB and CBG) are configured? | QC, MTK, Intel,vivo, LG, OPPO | Sharp, Nokia, NSB, ZTE, Samsung, Lenovo, Motorola Mobility |
| A16 | What NFI value should a UE assume when the UE is provided with UL DAI (different than 4) for a PDSCH group that was not scheduled for the UE? | Nokia, NSB (essentiality is similar to B8, we think it is good to clarify in spec), LG (agree with Nokia on the necessity to clarify) | Sharp, ZTE, OPPO |
| A17 | Out-of-Order issue for NNK1 | QC (prefer to discuss this as part of C as this is a general issue of NNK1), Sharp, Nokia, NSB (we are OK with proposal, but TP may need update), OPPO |  |
| A18 | Handling of DCI format 1\_0 indicating a SPS PDSCH release in enhanced dynamic HARQ-ACK codebook | QC (this is editorial, and there may be easier ways, e.g. not mention “PDSCH reception”), MTK (editorial, QC’s suggestion is also acceptable), Sharp, Nokia, NSB (necessary clarification), Intel (should be less controversial) , ZTE (editorial), Samsung(editorial) , Lenovo (only editorial change is needed), Motorola Mobility, vivo(editorial), LG (seems just editorial) | OPPO (editorial, suggest not to use email thread) |
| A19 | Proposal 1: HARQ-ACK information bits for PDSCH group 1 is placed in the last N bit positions and HARQ-ACK information bits for PDSCH group 0 is placed in the first (11-N) bit positions when RM coding is used and T-DAI for PDSCH group 1 is included in DCI scheduling PDSCH in PDSCH group 0. |  | QC (the proposal is an optimization and has been discussed before) , MTK, Sharp, Nokia, NSB, Intel, ZTE,vivo, LG, OPPO |
| A20 | Proposal 2: If a PDSCH for a given HARQ process is received, the UE skips another PDSCH for a given HARQ process until after the end of the successful transmission of HARQ-ACK for that HARQ process. | OPPO (in type3 thread) | MTK (this issue should be categorized in Type 3 codebook?), Sharp, Nokia, NSB, Intel, ZTE, Lenovo, Motorola Mobility, vivo(an issue for Type-3 codebook), LG |
| B1 | FFS on triggering Type-3 HARQ-ACK codebook feedback with a DCI that does not schedule a PDSCH and with CRS scrambled by CS-RNTI | MTK (clarification is needed), Sharp, Nokia, NSB, Intel, ZTE, Samsung, Lenovo, Motorola Mobility, vivo | QC (Given that this is already possible with C-RNTI, MCS-C-RNTI, the issue is not critical and specification is complete), LG (agree with QC that C-RNTI and MCS-C-RNTI are enough (not restrictive) for the purpose of Type-3 CB triggering), OPPO |
| B2 | Corrections in handling of spatial bundling for Type-3 HARQ-ACK codebook | QC (We prefer a simple correction, e.g. spatial bundling not allowed for Type-3) , Sharp, Nokia, NSB, Intel, ZTE, Samsung, Lenovo, Motorola Mobility, vivo, LG, OPPO |  |
| B4 | 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 | QC, Sharp, Intel (the FFS is actually for a typical case), vivo, LG, OPPO | Nokia, NSB |
| B5 | nHARQ-ACK definition for power control with type-3 codebook is missing | Intel (prefer to allow similar PC handling for all types of codebook), Samsung (complete power control for all codebook types) | Sharp, Nokia, NSB, ZTE, vivo, LG |
| B6 | Handling of collisions between SPS-release Ack and type-3 HARQ-ACK codebook feedback, potential inclusion of a SPS release HARQ-ACK in Type 3 HARQ-ACK codebook (not currently specified) | QC, Sharp, Nokia, NSB, Intel, Samsung, Lenovo, Motorola Mobility, vivo, OPPO |  |
| B8 | If all the DCIs requesting one-shot feedback are missed, then UE and gNB are not aligned in the slot where the UE is supposed to report the type-3 codebook.  Case 1: if a collision with a PUCCH occasion for type2 (or type1) codebook happens, instead of reporting type3 codebook (as agreed) the UE will report type2 (or type1) codebook, resulting in mismatch with gNB’s expectation. In case of piggyback on PUSCH, this results in UL-SCH rate-matching issue.  Case 2: if there is no collision with a PUCCH occasion for type2 (or type1) codebook, if no PUSCH is transmitted in that slot then gNB does not receive any PUCCH, otherwise if a PUSCH is transmitted for reporting type2 (or type1) codebook then this results in UL-SCH rate-matching issue. | Nokia, NSB (essentiality is similar to A16, we think it is good to clarify in spec, sure gNB can send multiple triggers, but why such inefficiency is forced to be implemented by gNB) | QC (this is not specific to PUSCH as the same scenario is applicable to PUCCH. The issue can be avoided by sending multiple DCIs requesting Type-3) , Sharp, Intel, ZTE, Lenovo, Motorola Mobility, vivo, OPPO |
| B11 | Timeline for UCI Piggybacked on PUSCH for Type-3 HARQ-ACK codebook  A UE does not expect to detect a DCI format scheduling a PDSCH reception or a SPS PDSCH release or a DCI format including a One-shot HARQ-ACK request field with value 1 and indicating a resource for a PUCCH transmission with corresponding HARQ-ACK information in a slot if the UE previously detects a DCI format scheduling a PUSCH transmission in the slot and if the UE multiplexes HARQ-ACK information in the PUSCH transmission. | QC, MTK, Nokia, NSB (good to clarify), Iintel, ZTE, Samsung, Lenovo, Motorola Mobility, vivo, LG, OPPO | Sharp |
| B12 | Processing time for cancelling PUCCH indicated by another DCI  Proposal 1: The processing time requirement is set as a first value if Type-3 HARQ-ACK codebook in a first PUCCH is triggered by a first DCI format. In a case that a second DCI format indicates a second PUCCH which overlaps with the first PUCCH (and the first PUCCH is cancelled), the processing time requirement is set as a second value from the first DCI format to the second PUCCH. | Sharp (Note that the current spec does not specify the processing time requirement for cancelling other PUCCHs when Type-3 HARQ-ACK is triggered.  @QC: It is not limited to the case where the PUCCH to be canceled is latterly indicated. E.g., consider the case where firstly a second DCI indicating a second PUCCH is detected, and then a first DCI triggering one-shot feedback and indicating a first PUCCH is detected.) | QC (why would gNB schedule a later PUCCH knowing that it will be canceled? The current N3 value in Section 9.2.3 is for PRI overwriting when an earlier PUCCH resource is overwritten by a later DCI’ PRI), Nokia, NSB (there is already spec support for this), Intel, vivo, LG, OPPO |
| B13 | Proposal 6: When a DCI format 1\_1 triggers one-shot feedback without scheduling PDSCH, a chosen set of unused fields in this DCI format is reinterpreted to assist one-shot HARQ-ACK reporting and control/reduce the codebook size. |  | QC (this is an optimization that requires many spec changes. Definitely not essential), Sharp, Nokia, NSB (optimization), Intel, ZTE, Samsung, Lenovo, Motorola Mobility,vivo, OPPO |
| C1 | SPS with enhanced dynamic codebook  - FFS: DCI format 1\_1 should not simultaneously indicate a NNK1 value and indicate Scell dormancy  - FFS: DCI format 1\_1 should not simultaneously indicate a NNK1 value and indicate SPS release | QC (the issue is not limited to enhanced dynamic codebook. Also, the second bullet can be discussed as part of B6), MTK, Sharp, Nokia, NSB, Intel (need to narrow down the scope, since there is an agreement in MR-DC, “Case 2 dormancy indication using DCI format 1-1 is not supported for the case when DCI CRC is scrambled by CS-RNTI” ) , ZTE, Samsung, Lenovo, Motorola Mobility, vivo(related to B6), LG (agree with QC that these FFS points are not limited to enhanced Type-2 CB), OPPO |  |
| C2 | DCI formats 0\_2/1\_2 usage with PUCCH priority in case of NNK1 value signaled in PDSCH-to-HARQ\_feedback timing indicator | Nokia, NSB (NN-K1 should be supported with 1\_2 (spec clarification is essential), but e-TYPE2 CB should not be supported with 1\_2, conclusion is needed) | ZTE (at least the enhanced type2/type 3 CB for DCI format 1\_2 should not be discussed in Rel-16), OPPO |
| D1 | Multi-PUSCH scheduling (LS R1-2004665) | QC (if needed to be discussed as part of this AI), MTK, Sharp, Nokia, NSB, Intel,vivo, LG |  |

# Annex – Details about issues for email discussions A, B, C

## Issue A5

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| A5 | TS38.213 clause 9.1.3.3: nHARQ-ACK definition for power control with enhanced dynamic codebook is missing |

Proposal: discuss at RAN1#101-e.

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| **Company** | **Summary of proposals** |
| Huawei  (R1-2003514) | In NR-U, since the DAI are accumulated within each PDSCH group, and the SPS PDSCH does not belong to any group, if HARQ-ACK feedback for both groups are requested, and , UE should determine the number of HARQ-ACK information bits for each group and SPS, separately. The TP is provided as following:  **TP#4 for TS 38.213 Clause 9.1.3.3**  === Unchanged part omitted ===  If , the UE  includes only the first HARQ-ACK information for multiplexing in PUCCH transmission occasion  elseif  if g = 1  appends the first HARQ-ACK information to the second HARQ-ACK information for multiplexing in PUCCH transmission occasion  else  append the second HARQ-ACK information to the first HARQ-ACK information for multiplexing in PUCCH transmission occasion  end if  end if  If a UE is not provided *PDSCH-CodeBlockGroupTransmission* for each of the  serving cells, or for PDSCH receptions scheduled by a DCI format that does not support CBG-based PDSCH receptions, or for SPS PDSCH reception, or for SPS PDSCH release, and if , the UE determines a number of HARQ-ACK information bits  for obtaining a transmission power for a PUCCH, as  where   * is the number of SPS PDSCH receptions by the UE on serving cell  for which the UE transmits corresponding HARQ-ACK information in the PUCCH * is defined in clause 9.1.3.1 * is defined in clause 9.1.3.1 with and counted separately for each PDSCH group * and are defined in clause 9.1.3.1 except that the numbers are counted separately for each PDSCH group. If , =.   If a UE   * is provided *PDSCH-CodeBlockGroupTransmission* for  serving cells; and * is not provided *PDSCH-CodeBlockGroupTransmission*, for  serving cells where   If , the UE also determines  for obtaining a PUCCH transmission power, as described in Clause 7.2.1, with  where   * is defined in clause 9.1.3.1 * is defined in clause 9.1.3.1 with and counted separately for each PDSCH group * and are defined in clause 9.1.3.1 except that the numbers are counted separately for each PDSCH group. If , =.   === Unchanged part omitted === |
| Samsung  (R1-2003862) | Rel-15 equation is reused for each PDSCH group respectively, except the following revision:   1. for group (g+1)mod2, if , the last DCI contains T-DAI for group (g+1)mod2 and should be determined by . 2. The number of SPS PDSCH receptions  is only calculated in group g and set to 0 for group (g+1)mod2 to avoid duplicated calculation.   Proposal 1: For enhanced dynamic HARQ-ACK codebook using PUCCH format 2 or PUCCH format 3 or PUCCH format 4, if the number of UCI bits is smaller than or equal to 11, the HARQ-ACK information bits for power control should consist of the HARQ-ACK information bits for both PDSCH groups and SPS PDSCH reception(s) when gNB triggers HARQ-ACK feedback for both PDSCH groups..  TP for clause 9.1.3.3  ------------------ Unchanged part omitted ------------------------  The UE appends the HARQ-ACK information corresponding to SPS PDSCH receptions, if any, as described in Clause 9.1.3.1, after the first and second, if any, HARQ-ACK information.  If , the UE determines a number of HARQ-ACK information bits  for obtaining a transmission power for a PUCCH, as described in Clause 7.2.1, as    where  and are determined as in Clause 9.1.3.1 for PDSCH group *g* and , respectively, except that for group , and if , .  ------------------ Unchanged part omitted ------------------------ |
| Vivo  (R1-2003372) | Proposal 2: For enhanced dynamic codebook, to apply should be the sum of across all reported PDSCH group(s) in a PUCCH transmission occasion, i.e. , when the number of UCI bits for the PUCCH transmission occasion is smaller than or equal to 11. |
| Nokia  (R1-2004257) | **Proposal 1:** Type 2 CB rule for is used separately for each PDSCH group.  is given by , when available, for the non-scheduled PDSCH group.  **TP for TS38.213:** 9.1.3.3 Type-2 HARQ-ACK codebook grouping and HARQ-ACK retransmission <unchanged text omitted >  If , the UE  includes only the first HARQ-ACK information for multiplexing in PUCCH transmission occasion  elseif  if g = 1  appends the first HARQ-ACK information to the second HARQ-ACK information for multiplexing in PUCCH transmission occasion  else  append the second HARQ-ACK information to the first HARQ-ACK information for multiplexing in PUCCH transmission occasion  end if  end if  If , the UE determines a number of HARQ-ACK information bits groups and separately as described in Clause 9.1.3.1, with the following modification that if , UE sets = . If , the UE sets else UE sets for obtaining a transmission power for a PUCCH.  <unchanged text omitted > |
| Qualcomm  (R1-2004445) | If a UE is not provided *PDSCH-CodeBlockGroupTransmission* for each of the  serving cells, or for PDSCH receptions scheduled by a DCI format that does not support CBG-based PDSCH receptions, or for SPS PDSCH reception, or for SPS PDSCH release, and if , and if the UE includes both first and second HARQ-ACK information for multiplexing in the PUCCH, the UE determines a number of HARQ-ACK information bits  for obtaining a transmission power for a PUCCH, as described in Clause 7.2.1, as    where   * and are defined in Clause 9.1.3.1. * and are defined in Clause 9.1.3.1 except that the numbers are counted each PDSCH group index separately. * is defined in Clause 9.1.3.1 except that it is determined for each PDSCH group index separately. If and for , . |
| Ericsson  (R1-2003845) | Adopt TP in R1-2002532  Proposals might have an issue with counting the HARQ-ACK information corresponding to SPS receptions twice or even not counting them at all since the generation of the codebook for each group excludes the generation of HARQ-ACK information for SPS PDSCH receptions. |

## Issue A7

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| A7 | TS38.213 clause 9.1.3.3: How is T-DAI interpreted in DCI 1\_1 for the non-scheduled group when two sub-codebooks (for TB and CBG) are configured? |

Issues A7 addresses the following text in TS38.213 section 9.1.3.3:

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| If or , generate second HARQ-ACK information for PUCCH transmission occasion in a slot, as described in Clause 9.1.3.1, where  […]  - if , after the completion of the and loops for the pseudo-code for the second HARQ-ACK codebook generation in Clause 9.1.3.1, set for both sub-codebooks, if any. |

Alternatives (R1-2002923 FL summary#1 on email discussion 100b-e-NR-unlic-NRU-HARQ-02):

* Clarify that codebook generation procedures in 38.213 clause 9.1.3.3 are applied separately for the first sub-codebook and the second sub-codebook
* Handling of T-DAI for the non-scheduled group
  + Alt1: Clarify that a UE is not expected to generate HARQ-ACK information if T-DAI for the non-scheduled group in DCI 1\_1 is smaller than T-DAI received for any of the two sub-codebooks (TB, CBG) in earlier DCIs scheduling the same group if NFI was not toggled for the group.
  + Alt2: Introduce 2 additional bits for T-DAI field in DCI format 1\_1 when *NFI-TotalDAI-Included-r16 is configured* and PDSCH-CodeBlockGroupTransmission is configured for at least one serving cell, i.e. T-DAI is provided for the non-scheduled group for both sub-codebooks
  + Alt3: UE is not expected to be configured with *NFI-TotalDAI-Included-r16* when PDSCH-CodeBlockGroupTransmission is configured for at least one serving cell
  + Alt4: T-DAI for the non-scheduled group is associated to the TB or CBG type of the scheduled PDSCH
  + Alt5: T-DAI for the non-scheduled group is always associated to the TB type scheduling

FL summary: Two companies prefer not to continue discussing issue A7. A majority of companies will propose introducing new bits in DCI. Should it be at least clarified what should be the interpretation of “if any”, whether it refers to configuration or dynamic scheduling?

Proposal: FFS whether to further discuss at RAN1#100b-e.

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| **Company** | **Summary of proposals** |
| Huawei  (R1-2003514) | A potential ambiguity remains in the interpretation of “if any”, which could be interpreted either as configuration of two sub-codebooks or detection of DCIs for both sub-codebooks in the set of monitoring occasions corresponding to the PUCCH occasion.  **TP#1 for TS 38.213 Clause 9.1.3.3(on top of R1-2003180)**  === Unchanged part omitted ===  - the PUCCH transmission occasion is a last one for multiplexing second HARQ-ACK information and it is not after PUCCH transmission occasion  - if ,   * if the UE is provided *PDSCH-CodeBlockGroupTransmission* for serving cells, and is not provided *PDSCH-CodeBlockGroupTransmission* for serving cells , after the completion of the and loops for the pseudo-code for the second HARQ-ACK codebook generation in Clause 9.1.3.1, set for both sub-codebooks before appending the second sub-codebook to the first sub-codebook. * Otherwise, after the completion of the and loops for the pseudo-code for the second HARQ-ACK codebook generation in Clause 9.1.3.1, set .   === Unchanged part omitted === |
| Vivo  (R1-2003372) | It should be determined how to indicate and apply when the second HARQ-ACK codebook contains two sub-codebooks  In Figure below, when there are a number of consecutive DCI format(s) at the end of a sub-codebook and miss-detected by UE, with the number smaller than 4 which is supposed by NR Rel-15, applying a same total DAI of either the smaller or larger one to two sub-codebooks will cause misalignment between UE and gNB.    *Proposal:* *When the RRC parameter NFI-TotalDAI-Included-r16 = enable and two sub-codebooks may be applied, i.e., PDSCH-CodeBlockGroupTransmission is provided at least for a serving cell, indicating separate total DAIs for each sub-codebook respectively for the non-scheduled PDSCH group in a non-fallback DCI format.* |
| OPPO  (R1-2004087) | Proposal 6: Two T-DAIs for TB sub-codebook and CBG sub-codebook of the non-scheduled PDSCH group can be configured in DCI format 1\_1 |
| LG  (R1-2004015) | For the case when CBG based PDSCH transmission is configured and T-DAI indication for the non-scheduled PDSCH group is configured for DL DCI, Two T-DAI values are indicated for the non-scheduled PDSCH group:   * One value corresponds to TB-based PDSCH. * The other value corresponds to CBG-based PDSCH   For the case when CBG based PDSCH transmission is configured and T-DAI indication for both or one of two PDSCH groups is configured for UL DCI, the following is adopted, two T-DAI values are indicated per PDSCH group.   * One value corresponds to TB-based PDSCH. * The other value corresponds to CBG-based PDSCH. |
| Mediatek  (R1-2001904) | Introduce 2 additional bits for T-DAI field: DAI field in DCI format 1\_1 has 8 bits for enhanced dynamic HARQ-ACK codebook with two HARQ-ACK sub-codebooks and with NFI-TotalDAI-Included-r16 = enable. The 4 MSB bits are the counter DAI and the total DAI for the scheduled PDSCH group. The 4 LSB bits are the total DAI for the non-scheduled PDSCH group, where two bits apply separately for each HARQ-ACK sub-codebook. |
| Nokia  (R1-2004257) | Proposal 2: Given that no consensus could be reached on the issue A7 in RAN1#100b, we propose not to discuss issue any more in RAN1#101 |
| Qualcomm  (R1-2004445) | The procedures described in Section 9.1.1.3 should be done separately for the two sub-codebooks:  --Unchanged part omitted------------------------  If or , generate second HARQ-ACK information for PUCCH transmission occasion in a slot, as described in Clause 9.1.3.1, where  - the second HARQ-ACK information corresponds to detections of DCI formats each providing a same value of , of and to detections of DCI formats that do not provide a value of , of , but are associated with a same value of , of ,  - at least one of the DCI formats provides a value  - corresponds to a PDCCH monitoring occasion, where the UE detects a DCI format that provides a value of or that is associated with a value of , that is the first PDCCH monitoring occasion after a PDCCH monitoring occasion where the UE detects another DCI format that provides a value different than  - the PUCCH transmission occasion is a last one for multiplexing second HARQ-ACK information and it is not after PUCCH transmission occasion  - if , after the completion of the and loops for the pseudo-code for the second HARQ-ACK codebook generation in Clause 9.1.3.1, set .  --Unchanged part omitted------------------------  The UE appends the HARQ-ACK information corresponding to SPS PDSCH receptions, if any, as described in Clause 9.1.3.1, after the first and second, if any, HARQ-ACK information.  If a UE is provided *PDSCH-CodeBlockGroupTransmission* for at least one serving cell, the procedures described in this Clause are applied separately for the first sub-codebook and the second sub-codebook, where the second sub-codebook is the CBG-based sub-codebook as described in Clause 9.1.3.1.  If the HARQ-ACK information is multiplexed in a PUSCH transmission, the HARQ-ACK information is determined as  --Unchanged part omitted------------------------ |
| Samsung  (R1-2003862) | Regarding how to understand “if , after the completion of the and loops for the pseudo-code for the second HARQ-ACK codebook generation in Clause 9.1.3.1, set for both sub-codebooks, if any”, some companies have some concerns about “if any”. In our understanding, “if any” means a UE is provided *PDSCH-CodeBlockGroupTransmission*. The UE behaviour is clear that, UE determines HARQ-ACK bits for both CBG and TB sub-codebooks according to the single , if a UE is provided *PDSCH-CodeBlockGroupTransmission* for at least one serving cell. gNB may only schedules one sub-codebook for a PDSCH group for a PUCCH, the UE still has to report some bits of NACK for non-scheduled sub-codebook according to . Although additional UCI overhead may be required, DCI overhead can be reduced. In addition, gNB can control the UCI overhead through a proper scheduling.  Observation: No need to further clarify the interpretation of T-DAI in DCI 1\_1 for the non-scheduled group when two sub-codebooks (for TB and CBG) are configured. |

## Issue A16

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| A16 | What NFI value should a UE assume when the UE is provided with UL DAI (different than 4) for a PDSCH group that was not scheduled for the UE? |

FL analysis: similar issue and proposals were discussed in WI phase. Companies are encouraged to comment on the essentiality of the proposed corrections.

Proposal: FFS whether to discuss at RAN1#101e

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| **Company** | **Summary of proposals** |
| Huawei  (R1-2003514) | The NFI information for this group should be ignored.  *No correction is needed for issue A16.* |
| ZTE  (R1-2003452) | For DL DCI, it is up to UE implementation on the interpretation of the NFI field for the non-scheduled group  For UL DCI, the NFI indication is not needed to signal and the NFI is not toggled for the non-scheduled PDSCH group. |
| Ericsson  (R1-2003845) | 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  (R1-2004015) | Proposal #3: 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 toggled (or non-toggled) from the latest value.  - Alt 2: NFI (for the PDSCH group) is signaled via the UL DCI (as for DL DCI) |
| Nokia  (R1-2004257) | **Proposal 4:** *If UE receives DCI format 0\_1 with while the UE has not detected any DCI scheduling PDSCH for the PDSCH group, and the UE has not detected any DCI requesting HARQ-ACK information for the PDSCH group, UE toggles the NFI if UL DAI is smaller than the latest received T-DAI.*  **TP for TS38.213:** 9.1.3.3 Type-2 HARQ-ACK codebook grouping and HARQ-ACK retransmission <unchanged text omitted >  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 does not multiplex HARQ-ACK information in the PUSCH transmission for the PDSCH group index.  If a UE is scheduled a PUSCH transmission by DCI format 0\_1 having a DAI field value for a PDSCH group index *k*, 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, and , where is the latest value used in previous HARQ information transmission for the PDSCH group, UE togglesvalue for the PDSCH group before the generation of the HARQ information for the PDSCH group.  If a UE detects DCI formats with respective PDSCH-to-HARQ\_feedback timing field values indicating a same PUCCH transmission occasion and none of the DCI formats that the UE detects after a last PUCCH transmission occasion for includes a New\_Feedback indicator field for , and at least one of the DCI formats is DCI format 1\_0, the UE generates HARQ-ACK information only for PDSCH receptions scheduled by detections of DCI format 1\_0, as described in Clause 9.1.3.1 or 9.1.3.2 for multiplexing in the PUCCH transmission occasion.  <unchanged text omitted > |
| Google  (R1-2004529) | Observation 1: For reporting HARQ-ACK information in a PUCCH, if associated PDSCH transmissions are scheduled with DCI formats with different PDSCH group index and with different *Number of requested PDSCH group(s) field* values, the HARQ-ACK information may cause error when the DCI with *Number of requested PDSCH group(s) field* values of 1 is miss detected.  Observation 2: For multiplexing HARQ-ACK information in a PUSCH scheduled by a DCI with *UL-TotalDAI-Included-r16* configured, the UL DAI can be used to update the *Number of requested PDSCH group(s) field* values. However, in the current spec, the UE only multiplexes the HARQ-ACK information of both PDSCH groups when detecting a DCI with the *Number of requested PDSCH group(s) field* values of 1.  **Text proposal #1 for 38.213**  9.1.3.3 Type-2 HARQ-ACK codebook grouping and HARQ-ACK retransmission  *\*\*\* Unchanged text is omitted \*\*\**  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 multiplex HARQ-ACK information in the PUSCH transmission for the PDSCH group index as .  \*\*\* Unchanged text is omitted \*\*\* |

## Issue A17 (new)

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| A17 (new) | Out-of-Order issue for NNK1 |

FL analysis: other companies are invited to comment on the essentiality of the proposed correction

Proposal: potentially discuss at RAN1#101-e

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| **Company** | **Summary of proposals** |
| Qualcomm  (R1-2004445) | Non-numeric K1 may result in out-of-order operation. This can happen when a first DCI that indicates non-numeric K1 is detected but a second DCI that indicates a numeric K1 (and was supposed to indicate the timing for HARQ-Ack for the PDSCH scheduled by the first DCI) is missed.    **Proposal 2. HARQ-Ack for a PDSCH that is scheduled with a non-numeric K1 is multiplexed in the next PUCCH that carries HARQ-Ack and satisfies the UE PDSCH processing timeline for the PDSCH if UE has not detected the second DCI with numeric-K1 that points to an slot earlier than the PUCCH slot**.  ==TP for 38.213 Section 9.1.3===  --Unchanged part omitted------------------------  If a UE receives a first PDSCH scheduled by 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 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.  - if there is a PUCCH or PUSCH transmission in a slot that carries HARQ-Ack and satisfies timing conditions in Clause 9.2.5, and the second DCI has not been detected that points to an earlier slot for HARQ-Ack transmission, the UE multiplexes the HARQ-ACK information for the first PDSCH in the PUCCH or PUSCH transmission in the slot.  --Unchanged part omitted------------------------ |

## Issue A18 (new)

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| A18 (new) | Handling of DCI format 1\_0 indicating a SPS PDSCH release in enhanced dynamic HARQ-ACK codebook |

FL analysis: other companies are invited to comment on the essentiality of the proposed correction

Proposal: potentially discuss at RAN1#101-e

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| **Company** | **Summary of proposals** |
| MediaTek  (R1-2003658) | In NR, DCI format 1\_0 is possible to be used for indicating a DL SPS release. However, if UE detects a DCI format 1\_0 indicating a DL SPS release, it is not clear in current specification how UE handle the DCI format 1\_0 since only defines behavior for PDSCH reception scheduled by DCI format 1\_0. We believe that the missing UE behaviour should be also completed in TS38.213 clause 9.1.3.3.  **Proposal 2: Text proposal 2 is adopted in TS38.213 clause 9.1.3.3 to complete UE behavior to DCI format 1\_0 indicating a SPS PDSCH release in enhanced dynamic HARQ-ACK codebook.**  ====**Text Proposal 2 Starts**==== 9.1.3.3 Type-2 HARQ-ACK codebook grouping and HARQ-ACK retransmission \*\*\* Unchanged text is omitted \*\*\*  If a UE detects DCI formats with respective PDSCH-to-HARQ\_feedback timing field values indicating a same PUCCH transmission occasion and none of the DCI formats that the UE detects after a last PUCCH transmission occasion for includes a New\_Feedback indicator field for , and at least one of the DCI formats is DCI format 1\_0, the UE generates HARQ-ACK information only for PDSCH receptions scheduled by detections of DCI format 1\_0 and SPS PDSCH releases indicated by detections of DCI format 1\_0 by detections of DCI format, as described in Clause 9.1.3.1 or 9.1.3.2 for multiplexing in the PUCCH transmission occasion.  If a DCI format indicating a slot for a PUCCH transmission occasion does not include a New\_Feedback indicator field, a PDSCH reception scheduled by the DCI format or a SPS PDSCH release indicated by the DCI format is associated with PDSCH group 0 and a value of *h*(*g*) associated with the DCI format is set only if *h*(*g*) is provided by another DCI format that provides a value of *h*(*g*) for PDSCH group 0 and indicates the slot for the PUCCH transmission occasion.  \*\*\* Unchanged text is omitted \*\*\*  ===== **Text Proposal 2 Ends**==== |

## Issue B1

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| B1 | FFS on triggering Type-3 HARQ-ACK codebook feedback with a DCI that does not schedule a PDSCH and with CRS scrambled by CS-RNTI |

Rel-16 URLLC changed the FDRA field values for validation of UL grant release, and clarified the FDRA values with *dynamicSwitch* for DL SPS release (the same clarification is also made for single SPS PDSCH):

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| Table 10.2-4: Special fields for a single or multiple DL SPS and UL grant Type 2 scheduling release PDCCH validation when a UE is provided multiple DL SPS or UL grant Type 2 configurations in the active DL/UL BWP of the scheduled cell   |  |  |  | | --- | --- | --- | |  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_1/1\_2 | | Redundancy version | set to all '0's | set to all '0's | | Modulation and coding scheme | set to all '1's | set to all '1's | | Frequency domain resource assignment | set to all '0's ~~for FDRA Type 0 or~~ for FDRA Type 2 with  set to all '1's, otherwise ~~for FDRA Type 1 or for FDRA Type 2 with~~ | set to all '0's for FDRA Type 0 or for *dynamicSwitch*  set to all '1's for FDRA Type 1 | |

Proposal: discuss at RAN1#101-e

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| **Company** | **Summary of proposals** |
| Huawei  (R1-2003514) | ***Proposal 3: UE should ignore the value of one-shot HARQ-ACK request field when the DCI signals a validation for DL SPS.***  ***Proposal 4: Type-3 HARQ-ACK codebook request without PDSCH scheduling should not be triggered by DCI with CS-RNTI.***  It can be found that the FDRA field values for SPS release PDCCH validation and Type-3 HARQ-ACK codebook request without scheduling PDSCH are basically the same except when resource allocation scheme is configured as “*dynamicSwitch*”. To avoid the ambiguity between these two cases, the UE should ignore the value of one-shot HARQ-ACK request field when the DCI signals a validation for DL SPS (Alt-2), and Type-3 HARQ-ACK codebook should not be triggered by DCI with CS-RNTI.  TP#5 for TS 38.212 Clause 10.2  === Unchanged part omitted ===  If validation is achieved, the UE considers the information in the DCI format as a valid activation or valid release of DL SPS or configured UL grant Type 2. If validation is not achieved, the UE discards all the information in the DCI format.  If validation for release of DL SPS is achieved, the UE ignores the value of One-shot HARQ-ACK request field, if any.  === Unchanged part omitted === |
| LG  (R1-2004015) | Proposal #6: DCI format 1\_1 scrambled by CS-RNTI is not allowed to trigger Type-3 one-shot codebook (without PDSCH scheduling). |
| Nokia  (R1-2004257) | R16 URLLC AI has made changes to validation of UL grant release, but DL SPS release remained unchanged and its validation is unified with validation of DCIs indicating dormancy and TYPE-3 trigger DCI but not scheduling PDSCH.  In our opinion, DCI Format 1\_1 scrambled by CS-RNTI shall be allowed to trigger TYPE-3 CB, particularly for DL SPS release. When HARQ process starvation occurs due to PUCCH LBT failure, gNB may stop DL SPS, pull HARQ-ACK with TYPE-3 CB and restart DL SPS afterwards. Irrespective of whether HARQ-ACK for DL SPS release is supported or not (B6), no additional specification effort is needed to support TYPE-3 CB trigger in DL SPS release, because processing timelines are same for DL SPS release and TYPE-3 CB trigger and both DL SPS release and TYPE3 CB trigger will be validated based on “zero-RA”.  **Observation 1**: *Irrespective of whether HARQ-ACK for DL SPS release is supported or not (B6), no additional specification effort is needed to support TYPE-3 CB trigger in DL SPS release*  **Proposal 5: *Support DCI format 1\_1 scrambled by a CS-RNTI and triggering TYPE-3 CB by removing brackets from ~~[~~CS-RNTI~~]~~ in sub-clause 9.1.4 in TS 38.213*** |
| Sharp  (R1-2004325) | **Proposal 2: Support to use a DCI format with CS-RNTI for Type-3 HARQ-ACK codebook triggering without scheduling PDSCH.**  If simultaneous Type-3 HARQ-ACK codebook triggering and SPS release indication is supported, it seems reasonable to assume that the UE requires more time to process two tasks (Type-3 HARQ-ACK codebook generation and SPS release) than one task (Type-3 HARQ-ACK codebook generation).  **Proposal 3: The processing time requirement is set as a first value if Type-3 HARQ-ACK codebook without scheduling PDSCH is triggered by a first DCI format. In a case that the first DCI format also triggers SPS release, the processing time requirement is set as a second value which is larger than the first value. Adopt TP #2.**  --------- beginning of text proposal for TS 38.213  **9.1.4 Type-3 HARQ-ACK codebook determination**  -------- Unchanged contents are omitted  A UE is expected to provide HARQ-ACK information in response to a type-3 HARQ-ACK codebook request without scheduling PDSCH after *N* symbols from the last symbol of a PDCCH providing the type-3 HARQ-ACK codebook request without scheduling PDSCH, where the value of *N* for μ= 0, 1, 2, [3] is determined as in clause 10.2 except that the PDCCH providing the type-3 HARQ-ACK codebook request is used instead of the PDCCH providing the SPS PDSCH release. If the PDCCH providing the type-3 HARQ-ACK codebook request also indicates SPS PDSCH release, the UE is expected to provide HARQ-ACK information in response to a type-3 HARQ-ACK codebook request after symbols from the last symbol of the PDCCH, where is larger than and smaller than the PDSCH processing procedure time required in TS 38.214 Clause 5.3.  -------- Unchanged contents are omitted  --------- end of text proposal |

## Issue B2

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| B2 | Corrections in handling of spatial bundling for Type-3 HARQ-ACK codebook |

A problem was found in TS38.913 clause 9.1.3.4 when if *harq-ACK-SpatialBundlingPUCCH* is provided; else and , then HARQ-ACK feedback is provided for just one TB even if *maxNrofCodeWordsScheduledByDCI* = 2 for serving cell , without AND operation. In the same case in case reporting of NDI is configured, then NDI for just one TB is reported.

The following alternatives have been proposed in contributions:

* Alt1: spatial bundling is never applied to type-3 HARQ-ACK codebook even if *harq-ACK-SpatialBundlingPUCCH* is provided.
* Alt2: spatial bundling is applied to type-3 HARQ-ACK codebook when *harq-ACK-SpatialBundlingPUCCH* is provided, with AND operation for 2 TBs and with AND operation for 2 NDIs corresponding to the 2 TBs.
* Alt3: Spatial bundling is applied to Type-3 HARQ-ACK codebook, with AND operation for 2 HARQ-ACKs corresponding to 2 TBs and with 1 NDI for the first TB.
* Alt4: spatial bundling is never applied to type-3 HARQ-ACK codebook with CBG-based HARQ configured, otherwise spatial bundling is applied to type-3 HARQ-ACK codebook when *harq-ACK-SpatialBundlingPUCCH* with AND operation for 2 TBs followed with NDI bits for each TB in order of increasing TB index.

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| **Company** | **Summary of proposals** |
| Huawei (R1-2003514), Nokia (R1-2004257), Ericsson (R1-2003845), ZTE (R1-2003452) | Alt1 |
| Lenovo (R1-2003823) | Alt2 |
| LG (R1-2004015) | Alt3 |
| Vivo (R1-2003372), OPPO (R1-2004087) | Alt4 |

FL analysis: reporting of the type-3 HARQ-ACK codebook when spatial bundling is configured should be be fixed for the cases with and without NDI reporting, otherwise reporting as specified in TS38.213v16.1.10 is not useful since only HARQ-ACK information for the first TB is reported.

Proposal: discuss at RAN1#101e

## Issue B4 (FFS)

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| B4 | Issue B4 was resolved at RAN1#100e [1]  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 summary of companies’ proposals for the case where NDI is not configured to report in type-3 codebook:

* Huawei, Nokia, vivo: handle cases without sufficient PDSCH processing time as in 38.213v16.1.0
* Samsung (RAN1#100b-e), ZTE: generalize to more cases where UE reports NACK by default, including when UE already reported the information then detected another DCI (without sufficient processing time)
* Ericsson: similar as Samsung and ZTE but TP associated with proposal 3 implies that the UE can only re-transmit a HARQ-ACK bit but not transmit a new HARQ-ACK bit
* OPPO, LG, Intel: report ACK or NACK based on NDI in DCI without sufficient PDSCH processing time

FL analysis: too wide divergence of proposals, some companies do not see the need for further correction.

Proposal: no discussion at RAN1#101-e

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| **Company** | **Summary of proposals** |
| Vivo  (R1-2003372) | Proposal 8: UE is not expected to be required to report HARQ-ACK for a HARQ process which has been scheduled with a PDSCH without sufficient processing time when reporting one-shot HARQ-ACK codebook |
| ZTE  (R1-2003452) | 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  while  if UE has previously transmitted HARQ--ACK information for TB for HARQ process number on serving cell , 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  or UE has not yet obtained HARQ-ACK information for a TB corresponding to a scheduled PDSCH reception        end if  FL note: the TP is not against the latest version of 38.213v16.1.0 |
| OPPO  (R1-2004087) | To prepare the one-shot codebook, when UE has previously reported HARQ-ACK with a TB for a HARQ process number, if the UE has detected another DCI format scheduling a PDSCH with a TB for the same HARQ process number, and the UE does not have enough processing time for PDSCH decoding, the UE reports previously reported HARQ-ACK if the PDSCH is a retransmission; NACK, otherwise.  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  end if  if UE has reported HARQ-ACK information for TB for HARQ process number on serving cell , and has subsequently detected a DCI format scheduling a PDSCH reception with NDI not toggled with TB for HARQ process number on serving cell  while  = latest reported 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 subsequently detected a DCI format scheduling a PDSCH reception with NDI toggled with TB for HARQ process number on serving cell  while        end while  end if |
| LG  (R1-2004015) | For one-shot 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  (R1-2003730) | 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 |
| Ericsson  (R1-2003845) | In case of , the UE is expected to send the latest not previously transmitted feedback. But in case of , there is no such an expectation that the UE sends the NDI and HARQ feedback corresponding to the latest detected DCI for the HARQ process h.  Proposal 4:  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~~        ~~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  = HARQ-ACK information bit for TB for HARQ process of serving cell  else        end if      end while |
| Nokia  (R1-2004257) | For the remaining case when gNB scheduled PDSCH without sufficient processing time before PUCCH carrying TYPE-3 CB is left up to implementation. |

## Issue B5

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| B5 | nHARQ-ACK definition for power control with type-3 codebook is missing |

Proposal 2 (R1-2003862): For one-shot HARQ-ACK feedback, if NDI is not configured, and if the number of UCI bits is smaller than or equal to 11 bits, the NACK bits for a HARQ process without PDSCH receiving after previous transmitted PUCCH occasion is not counted for the purpose of PUCCH power control. TP for TS 38.213:

**TS 38.213**

**9.1.4 Type-3 HARQ-ACK codebook determination**

------------------ Unchanged part omitted ------------------------

If , and if the UE determines a number of HARQ-ACK information bits  for obtaining a transmission power for a PUCCH in PUCCH transmission occasion *i*, as described in Clause 7.2.1, aswhere

- is the number of transport blocks the UE receives after a previous transmitted PUCCH occasion *i-*1 for HARQ process ID *h* for serving cell  if *harq-ACK-SpatialBundlingPUCCH* and *pdsch-HARQ-ACK-OneShotFeedbackCBG-r16* are not provided, or the number of PDSCH receptions if *harq-ACK-SpatialBundlingPUCCH* is provided.

- is the number of CBGs the UE receives after a previous transmitted PUCCH occasion *i-*1 for HARQ process ID *h* for serving cell  if *PDSCH-CodeBlockGroupTransmission* and *pdsch-HARQ-ACK-OneShotFeedbackCBG-r16* is provided.

------------------ Unchanged part omitted ------------------------

…

FL analysis: this proposal was considered non-critical at RAN1#100-e (the number of reported bits < 11 happens rarely and only for special configurations). Several companies still considered it as a corner case at RAN1#100b-e, although the case is not specified. Still just one company contributed on this issue.

Proposal: no discussion at RAN1#101-e

## Issue B6

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| B6 | Handling of collisions between SPS-release Ack and type-3 HARQ-ACK codebook feedback, potential inclusion of a SPS release HARQ-ACK in Type 3 HARQ-ACK codebook (not currently specified) |

FL view: V16.1.0 of the specifications imply that SPS release HARQ-ACK would be dropped in case of collisions with reporting of type-3 HARQ-ACK codebook in the same slot.

Proposal: discuss at RAN1#101e

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| **Company** | **Summary of proposals** |
| Vivo  (R1-2003372) | Proposal 7: Support HARQ-ACK feedback for SPS PDSCH release in one-shot HARQ-ACK codebook. HARQ-ACK corresponding to a SPS PDSCH release is mapped to a HARQ process in the one-shot feedback, where the HARQ process is determined based on the HARQ process ID derivation for SPS PDSCH in TS38.321 and the SPS PDSCH location for the derivation is determined based on the following options:  • Option 1: A SPS PDSCH location in time domain explicitly indicated by the SPS release DCI, e.g. by TDRA field in the DCI, or as well as by the slot/symbol where the SPS release DCI is detected.  • Option 2: A SPS PDSCH location in time domain implicitly derived according to the SPS configuration to which the SPS release DCI corresponds, e.g. the next SPS PDSCH occasion corresponding to the SPS configuration after the reception of the SPS release DCI. |
| ZTE  (R1-2003452) | For DCI Format 1\_1 with CRC scrambled by CS-RNTI used for SPS-release, if one-shot HARQ-ACK request field is present, UE ignores the value of one-shot HARQ-ACK request field.  Issue B6 can be avoided by gNB scheduling that Type 3 HARQ-ACK codebook does not include the HARQ-ACK for SPS release. |
| Huawei  (R1-2003514) | ***Proposal 5: One bit at the end of Type-3 codebook could be reserved for SPS PDSCH release.***  **TP#7 for TS 38.213 Clause 9.1.4**  === Unchanged part omitted ===  end while      end while    if the UE receives a PDCCH indicating SPS PDSCH release and indicating a same slot for Type-3 codebook transmission by PDSCH-to-HARQ\_feedback timing indicator field  = ACK  else  = NACK  If a UE receives a SPS PDSCH, or a PDSCH that is scheduled by a DCI format 1\_0 for a serving cell and if *maxCodeBlockGroupsPerTransportBlock* is provided for serving cell , and *pdsch-HARQ-ACK-OneShotFeedbackCBG-r16* is provided, the UE repeats times the HARQ-ACK information for the transport block in the PDSCH.  === Unchanged part omitted === |
| Lenovo  (R1-2003823) | The bit for DL SPS release is placed at the first position then followed by the HARQ-ACK information bits for DL HARQ processes.  Proposal 2: HARQ-ACK information bit for DL SPS release is included in Type 3 HARQ-ACK codebook when it is to be transmitted in same slot with the Type 3 HARQ-ACK codebook. |
| Intel  (R1-2003730) | Proposal 2: For SPS PDSCH release, the associated HARQ process ID is indicated by TDRA field in DCI 1\_0 for SPS PDSCH release. 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.  …  If a UE receives a SPS PDSCH, or a PDSCH that is scheduled by a DCI format 1\_0 for a serving cell and if *maxCodeBlockGroupsPerTransportBlock* is provided for serving cell , and *pdsch-HARQ-ACK-OneShotFeedbackCBG-r16* is provided, the UE repeats times the HARQ-ACK information for the transport block in the PDSCH. If a UE receives a SPS PDSCH release, the HARQ process number used in Type-3 HARQ-ACK codebook determination is indicated by time domain resource assignment field in the DCI carrying the SPS PDSCH release.  If the UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1, the UE determines a PUCCH or a PUSCH to multiplex a Type-3 HARQ-ACK codebook for transmission in a slot as described in Clause 9.2.5. The UE multiplexes only the Type-3 HARQ-ACK codebook in the PUCCH or the PUSCH for transmission in the slot. |
| Samsung  (R1-2003862) | Proposal 3: Support HARQ-ACK multiplexing of SPS release and one-shot HARQ-ACK feedback at least for the following two cases,  Case a) A first DCI indicates SPS release and a second DCI indicates one-shot HARQ-ACK feedback with HARQ-ACK in the same PUCCH slot.  Case b) One DCI indicates both SPS release and one-shot HARQ-ACK feedback.  Proposal 4: For HARQ-ACK multiplexing of SPS release and one-shot HARQ-ACK feedback, for a SPS PDSCH configured in a serving cell, the HARQ-ACK information bit(s) of the HARQ process of the latest received SPS PDSCH in one-shot HARQ-ACK codebook is replaced by the HARQ-ACK information bit of the DCI indicating SPS release.  **TS 38.213**  **9.1.4 Type-3 HARQ-ACK codebook determination**  ------------------ Unchanged part omitted ------------------------  If a UE receives a SPS PDSCH, or a PDSCH that is scheduled by a DCI format 1\_0 for a serving cell and if *maxCodeBlockGroupsPerTransportBlock* is provided for serving cell , and *pdsch-HARQ-ACK-OneShotFeedbackCBG-r16* is provided, the UE repeats times the HARQ-ACK information for the transport block in the PDSCH.  If a UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1, the UE determines a PUCCH or a PUSCH to multiplex a Type-3 HARQ-ACK codebook for transmission in a slot as described in Clauses 9.2.3 and 9.2.5. The UE multiplexes only the Type-3 HARQ-ACK codebook in the PUCCH or the PUSCH for transmission in the slot. If the UE detects a DCI format indicating SPS release for a serving cell c with HARQ-ACK in the same PUCCH slot, the HARQ-ACK information bit(s) of the HARQ process of the latest received SPS PDSCH is replaced by the HARQ-ACK information bit of the DCI format indicating SPS release.  ------------------ Unchanged part omitted ------------------------ |
| Nokia  (R1-2004257) | **Proposal 8:** *A UE reports HARQ-ACK at HARQ process number corresponding to a earliest DL SPS PDSCH occasion after the SPS PDSCH release, where the earliest PDSCH occasions is defined as*   * *the earliest among the released DL SPS configuration(s), and* * *at least N symbols after the SPS PDSCH release.*   *HARQ process association between the DL SPS PDSCH occasion and HARQ process number is specified in [38.321 (MAC)].*  **TP associated with Proposal 8:** 9.1.4 Type-3 HARQ-ACK codebook determination <unchanged text omitted >  If a UE receives a SPS PDSCH, or a PDSCH that is scheduled by a DCI format 1\_0 for a serving cell and if *maxCodeBlockGroupsPerTransportBlock* is provided for serving cell , and *pdsch-HARQ-ACK-OneShotFeedbackCBG-r16* is provided, the UE repeats times the HARQ-ACK information for the transport block in the PDSCH.  If the UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1, the UE determines a PUCCH or a PUSCH to multiplex a Type-3 HARQ-ACK codebook for transmission in a slot as described in Clause 9.2.5. The UE multiplexes only the Type-3 HARQ-ACK codebook in the PUCCH or the PUSCH for transmission in the slot.  If a UE receives a SPS PDSCH release, UE reports HARQ-ACK at HARQ process number corresponding to the earliest DL SPS PDSCH occasion after the SPS PDSCH release, where the earliest PDSCH occasions is defined as   * the earliest among the released DL SPS configuration(s), and * at least N symbols after the SPS PDSCH release.   HARQ process association between the DL SPS PDSCH occasion and HARQ process number is specified in [38.321 (MAC)]. N is defined in sub-clause 10.2.  <unchanged text omitted > |
| OPPO  (R1-2004087) | Proposal 1: If a UE is triggered to report both one-shot and HARQ-ACK feedback for SPS PDSCH release in the same slot, the HARQ-ACK bit corresponding to the SPS PDSCH release is appended to the HARQ-ACK bits of all HARQ processes. |
| Ericsson  (R1-2003845) | If a UE is scheduled to report Type 3 HARQ-ACK codebook feedback and a HARQ-ACK bit corresponding to the SPS PDSCH release in the same PUCCH occasion, the HARQ-ACK bit corresponding to the SPS PDSCH release is appended at the end of the Type 3 codebook |
| Qualcomm  (R1-2004445) | Proposal 1. If UE is configured with a SPS configuration, one bit is appended to the end of Type-3 HARQ-Ack codebook. If UE detects a DCI format releasing an SPS configuration and indicates the slot in which the Type-3 HARQ-Ack is reported, the bit is set to Ack; otherwise, the bit is set to Nack.   * UE does not expect NN-K1 in a SPS release DCI.   The following two TPs address issue 1.  ==TP for 38.213 Section 9.1.3.3===  --Unchanged part omitted------------------------  Set – serving cell index  Set – HARQ process number  Set – TB index  Set – CBG index  Set  while  while  --Unchanged part omitted------------------------    end while      end while  if UE is provided with *sps-Config* or *sps-ConfigList-r16*  if UE has detected a DCI format corresponding to a valid release of DL SPS as described in Clause 10.2, and the DCI format indicates the slot in which the Type-3 HARQ-Ack is reported  =ACK  else  =NACK  end if  end if  --Unchanged part omitted------------------------ |

## Issue B8

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| B8 | If all the DCIs requesting one-shot feedback are missed, then UE and gNB are not aligned in the slot where the UE is supposed to report the type-3 codebook.  Case 1: if a collision with a PUCCH occasion for type2 (or type1) codebook happens, instead of reporting type3 codebook (as agreed) the UE will report type2 (or type1) codebook, resulting in mismatch with gNB’s expectation. In case of piggyback on PUSCH, this results in UL-SCH rate-matching issue.  Case 2: if there is no collision with a PUCCH occasion for type2 (or type1) codebook, if no PUSCH is transmitted in that slot then gNB does not receive any PUCCH, otherwise if a PUSCH is transmitted for reporting type2 (or type1) codebook then this results in UL-SCH rate-matching issue. |

R1-2004257 (proposal 9):

For UE with TYPE-2 CB and TYPE-3 CB configured:

* + When UE received UL-DAI=3 in PUSCH grant and hasn’t received any PDCCH for which HARQ-ACK is to be multiplexed in PUSCH, UE reports TYPE-3 CB
  + UE multiplexes TYPE-3 CB on the PUSCH
    - when UE receives DCI format 1\_1 with positive TYPE-3 CB trigger, or
    - when UE receives UL-DAI=3 in PUSCH grant and hasn’t received DL DAI value for more than 2 PDCCH for which HARQ-ACK is to be reported in the corresponding PUCCH.
  + Otherwise, UE multiplexes TYPE-2 CB on PUSCH according to UL-DAI received.

FL analysis: this issue was not considered critical by several companies at RAN1#100e and RAN1#10b-e. Still just one company contributed on this issue.

Proposal: no discussion at RAN1#101-e

## Issue B11 (new)

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| B11 (new) | Timeline for UCI Piggybacked on PUSCH for Type-3 HARQ-ACK codebook  A UE does not expect to detect a DCI format scheduling a PDSCH reception or a SPS PDSCH release or a DCI format including a One-shot HARQ-ACK request field with value 1 and indicating a resource for a PUCCH transmission with corresponding HARQ-ACK information in a slot if the UE previously detects a DCI format scheduling a PUSCH transmission in the slot and if the UE multiplexes HARQ-ACK information in the PUSCH transmission. |

FL analysis: other companies are invited to comment on the essentiality of the proposed correction

Proposal: potentially discuss at RAN1#101-e

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| **Company** | **Summary of proposals** |
| OPPO  (R1-2004087) | In Rel-15, the PDSCH/PDCCH received after a UL grant, the corresponding HARQ-ACK cannot be indicated to the slot for PUSCH transmission. Such limitation should also be supported for the DCI triggering one-shot HARQ-ACK feedback.  ***Proposal 5: Adopt TP3 for type-3 HARQ-ACK codebook piggybacked on PUSCH.***  -------------------------------Start of TP3 38.213 V16.1.0 section 9-------------------------------  9 UE procedure for reporting control information  <Unchanged parts are omitted>  A UE does not expect to detect a DCI format scheduling a PDSCH reception or a SPS PDSCH release or a DCI format including a One-shot HARQ-ACK request field with value 1 and indicating a resource for a PUCCH transmission with corresponding HARQ-ACK information in a slot if the UE previously detects a DCI format scheduling a PUSCH transmission in the slot and if the UE multiplexes HARQ-ACK information in the PUSCH transmission.  ------------------------------End of TP3 38.213 V16.1.0 section 9--------------------------------- |

## Issue B12 (new)

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| B12 (new) | Processing time for cancelling PUCCH indicated by another DCI.  Proposal 1: The processing time requirement is set as a first value if Type-3 HARQ-ACK codebook in a first PUCCH is triggered by a first DCI format. In a case that a second DCI format indicates a second PUCCH which overlaps with the first PUCCH (and the first PUCCH is cancelled), the processing time requirement is set as a second value from the first DCI format to the second PUCCH. |

FL analysis: other companies are invited to comment on the essentiality of the proposed correction

Proposal: potentially discuss at RAN1#101-e

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| **Company** | **Summary of proposals** |
| Sharp  (R1-2004325) | When another PUCCH (a second PUCCH indicated by a second DCI format) for HARQ-ACK codebook of other types overlaps with the first PUCCH, the UE shall cancel the second PUCCH transmission and perform one-shot HARQ-ACK feedback. Here, the processing time required for cancellation should be clarified in addition to the processing time for HARQ-ACK information multiplexing. In our view, condition on cancelling the second PUCCH is the same as the one for multiplexing processing time .    **Proposal 1: The processing time requirement is set as a first value if Type-3 HARQ-ACK codebook in a first PUCCH is triggered by a first DCI format. In a case that a second DCI format indicates a second PUCCH which overlaps with the first PUCCH (and the first PUCCH is cancelled), the processing time requirement is set as a second value from the first DCI format to the second PUCCH.**  --------- beginning of text proposal for TS 38.213  **9.2.3 UE procedure for reporting HARQ-ACK**  If a UE detects a first DCI format indicating a first resource for a PUCCH transmission with corresponding HARQ-ACK information in a slot and also detects at a later time a second DCI format indicating a second resource for a PUCCH transmission with corresponding HARQ-ACK information in the slot, the UE does not expect to multiplex HARQ-ACK information corresponding to the second DCI format in a PUCCH resource in the slot if the PDCCH reception that includes the second DCI format is not earlier than  from the beginning of a first symbol of the first resource for PUCCH transmission in the slot where, and are defined in clause 4.1 of [4, TS 38.211] and corresponds to the smallest SCS configuration among the SCS configurations of the PDCCHs providing the DCI formats and the SCS configuration of the PUCCH. If *processingType2Enabled* of *PDSCH-ServingCellConfig* is set to *enable* for the serving cell with the second DCI format and for all serving cells with corresponding HARQ-ACK information multiplexed in the PUCCH transmission in the slot, for ,  for ,  for ; otherwise ,  for ,  for ,  for ,  for .  If a UE detects a first DCI format that triggers type-3 HARQ-ACK codebook and indicates a first resource for a PUCCH transmission with corresponding HARQ-ACK information in a slot and if the UE also detects a second DCI format indicating a second resource for a PUCCH transmission with corresponding HARQ-ACK information in the slot, the UE expects that the second resource for PUCCH transmission is not earlier than *N*3 symbols from the ending of the first DCI format.  -------- Unchanged contents are omitted  --------- end of text proposal |

## Issue C1

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| C1 | SPS with enhanced dynamic codebook  - FFS: DCI format 1\_1 should not simultaneously indicate a NNK1 value and indicate Scell dormancy  - FFS: DCI format 1\_1 should not simultaneously indicate a NNK1 value and indicate SPS release |

Proposal: discuss at RAN1#101-e

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| **Company** | **Summary of proposals** | |
| ZTE  (R1-2003452) | DCI format 1\_1 should not simultaneously indicate a NNK1 value and indicate SPS release.  DCI format 1\_1 should not simultaneously indicate a NNK1 value and indicate Scell dormancy. | |
| Huawei  (R1-2003514) | DCI format 1\_1 should not simultaneously indicate a NNK1 value and indicate Scell dormancy  DCI format 1\_1 should not simultaneously indicate a NNK1 value and indicate SPS release  **TP#2 for TS 38.213 Clause 10.2(on top of R1-2003180)**  === Unchanged part omitted ===  A UE validates, for scheduling activation or scheduling release, a DL SPS assignment PDCCH or a configured UL grant Type 2 PDCCH if  - the CRC of a corresponding DCI format is scrambled with a CS-RNTI provided by *cs-RNTI*, and  - the new data indicator field in the DCI format for the enabled transport block is set to '0', and  - the DFI flag field, if present, in the DCI format is set to '0', and  - if the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format is present, the PDSCH-to-HARQ\_feedback timing indicator field does not provide an inapplicable value from *dl-DataToUL-ACK*.  === Unchanged part omitted ===  **TP#3 for TS 38.213 Clause 10.3(on top of R1-2003180)**  === Unchanged part omitted ===  If a UE is provided search space sets to monitor PDCCH for detection of DCI format 1\_1, and if  - the CRC of DCI format 1\_1 is scrambled by a C-RNTI or a MCS-C-RNTI, and if  - *resourceAllocation* = *resourceAllocationType0* and all bits of the frequency domain resource assignment field in DCI format 1\_1 are equal to 0, or  - *resourceAllocation* = *resourceAllocationType1* and all bits of the frequency domain resource assignment field in DCI format 1\_1 are equal to 1  - *resourceAllocation = dynamicSwitch* and all bits of the frequency domain resource assignment field in DCI format 1\_1 are equal to 0 or 1  - if the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format is present, the PDSCH-to-HARQ\_feedback timing indicator field does not provide an inapplicable value from *dl-DataToUL-ACK*.  the UE considers the DCI format 1\_1 as indicating SCell dormancy, not scheduling a PDSCH reception or indicating a SPS PDSCH release, and for transport block 1 interprets the sequence of fields of  === Unchanged part omitted === | |
| LG  (R1-2004015) | Proposal #7: DCI format 1\_1 indicating Scell dormancy operation or DL SPS release is not allowed to indicate NNK1 value (simultaneously) | |
| Nokia  (R1-2004257) | For both DL SPS release and Scell dormancy indication, precluding NNK1 value in DCI would imply a scheduling restriction, since DL SPS release nor Scell dormancy indication could be transmitted in the end of gNB COT. On the other hand, there is no specification impact from supporting these cases.  **Proposal 10: *Inapplicable value of K1 in DL SPS release and Scell dormancy DCI is not precluded*** | |
| Qualcomm  (R1-2004445) | | Proposal 1. If UE is configured with a SPS configuration, one bit is appended to the end of Type-3 HARQ-Ack codebook. If UE detects a DCI format releasing an SPS configuration and indicates the slot in which the Type-3 HARQ-Ack is reported, the bit is set to Ack; otherwise, the bit is set to Nack.   * UE does not expect NN-K1 in a SPS release DCI.   ===TP for 38.213 Section 10.2==  A UE validates, for scheduling activation or scheduling release, a DL SPS assignment PDCCH or a configured UL grant Type 2 PDCCH if  - the CRC of a corresponding DCI format is scrambled with a CS-RNTI provided by *cs-RNTI*, and  - the new data indicator field in the DCI format for the enabled transport block is set to '0', and  - the DFI flag field, if present, in the DCI format is set to '0', and  - the PDSCH-to-HARQ\_feedback timing indicator field,if present, does not provide an inapplicable value from *dl-DataToUL-ACK*.  If a UE is provided a single configuration for UL grant Type 2 PUSCH or for SPS PDSCH, validation of the DCI format is achieved if all fields for the DCI format are set according to Table 10.2-1 or Table 10.2-2.  --Unchanged part omitted------------------------ | |

## Issue C2 (URLLC & NRU with NNK1)

|  |  |
| --- | --- |
| D1 | DCI formats 0\_2/1\_2 usage with PUCCH priority in case of   * + NNK1 value signaled in PDSCH-to-HARQ\_feedback timing indicator   + Enhanced Type2 or Type 3 HARQ-ACK codebook configured |

FL analysis: other companies are invited to comment on the interpretation of the current specifications, and whether a correction or a clarification is necessary in case a DCI format 1\_2 indicates a NNK1 value.

Proposal: potentially discuss at RAN1#101-e

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| --- | --- |
| **Company** | **Summary of proposals** |
| MediaTek  (R1-2003658) | Proposal 1: When enhanced dynamic HARQ-ACK codebook is configured, reuse the mechanism specified for handling DCI format 1\_0 to handle DCI format 1\_2  On handling of DCI format with inapplicable K1 value, UE may multiplex the HARQ-ACK information corresponding to a first DCI format indicating an inapplicable K1 value in a PUCCH that is indicated by an applicable value in a second DCI format. According to current specification, UE only multiplexes UCIs with the same priority index in a PUCCH or PUSCH, and multiplexing procedure is behaved independently for each HARQ-ACK codebook that is associated with a PUCCH with one of the priority indexes. Thus, it is pretty clear that UE multiplexes the HARQ-ACK information corresponding to the first DCI format only when the second DCI format indicates a PUCCH with the same priority index.  Observation 2: If a UE receives a first DCI providing an inapplicable K1 value, and the UE detects a second DCI indicates a slot of PUCCH or PUSCH transmission by an applicable K1 value, it is clear in current specification that UE only multiplexes the corresponding HARQ-ACK information in the PUCCH or PUSCH transmission of a same priority index indicated by the first DCI, if applicable. |
| Ericsson  (R1-2003845) | Proposal 6: When two HARQ-ACK codebooks are configured for the same serving cell, if the UE detects a DCI scheduling a PDSCH and indicating Priority indicator value and inapplicable value for PDSCH-to-HARQ\_feedback timing indicator field, the HARQ-ACK information corresponding to the PDSCH is multiplexed in PUCCH occasion indicated by the immediate next DCI scheduling another PDSCH and indicating the same Priority indicator value and applicable value for PDSCH-to-HARQ\_feedback timing indicator.  Proposal 7: The presence of (PDSCH group index, New feedback indicator, Number of requested PDSCH group(s), total DAI for non-scheduled group) in DCI 1\_2 and (total DAI for non-scheduled group) in DCI 0\_2 can be disabled even when enhanced dynamic codebook is configured.  Proposal 8: The presence of One-shot HARQ-ACK request field in DCI 1\_2 can be disabled even if higher layer parameter pdsch-HARQ-ACK-OneShotFeedback-r16 is configured. |

# References

1. R1-2003372 Remaining issues on HARQ operation for NR-U vivo
2. R1-2003452 Remaining issues on the HARQ for NR-U ZTE, Sanechips
3. R1-2003514 Maintenance on HARQ-ACK enhancement Huawei, HiSilicon
4. R1-2003658 Remaining issues on HARQ operation for NR-U MediaTek Inc.
5. R1-2003730 Enhancements to HARQ for NR-unlicensed Intel Corporation
6. R1-2003823 Text proposals for HARQ enhancement for NR-U Lenovo, Motorola Mobility
7. R1-2003845 HARQ enhancement Ericsson
8. R1-2003862 HARQ enhancement for NR-U Samsung
9. R1-2004015 Remaining issues of HARQ procedure for NR-U LG Electronics
10. R1-2004087 Discussion on the remaining issues of HARQ enhancements OPPO
11. R1-2004257 Remaining issues on NR-U HARQ scheduling and feedback Nokia, Nokia Shanghai Bell
12. R1-2004325 Remaining issues and corrections on HARQ enhancement for NR-U Sharp
13. R1-2004445 TP for Enhancements to Scheduling and HARQ Operation for NR-U Qualcomm Incorporated
14. R1-2004529 Text proposal for enhanced dynamic HARQ procedures Google Inc.
15. R1-2004665 LS on Conflicting configurations RAN2, Huawei