**3GPP TSG RAN WG1 Meeting #100bis                     R1-200xxxx**

**e-Meeting, April 20th – 30th, 2020**

**Agenda Item: 7.2.2.2.3**

**Source: Moderator (Huawei)**

**Title: TP for NR-U HARQ issue B10**

**Document for: Discussion and Decision**

# Introduction

The discussion at RAN1#100b-e on NR-U issue B10 is summarized in [2]. This document provides TP proposals on issue B10 based on proposal 1 and 2 in [2].

This document provides TP proposals on issue B10 based on the proposal in [2] and based on the proposal “DCI format 1\_1 should not simultaneously indicate a NNK1 value and request feedback of Type-3 HARQ-ACK codebook (one-shot HARQ-ACK request field with value 1)” in [3].

For issue B10, 7 companies think a clarification is necessary with TPs for sections 9.1 and 9.1.2, where the TP for 9.1 could be based on the last sentence from clause 9.1.4 to clarify collision handling between type3 CB and other codebook types. 3 companies consider that a TP is not needed. A common understanding of the current specification text has not yet been reached.

The intended behavior according to NR-U agreements is commonly understood:

* Type-3 CB can be triggered and reported when no DCI indicated a NNK1 value
* Type-3 CB can report HARQ-ACK information for a PDSCH scheduled with NNK1 when UE is configured with type-1 CB
* Type-1 CB cannot report HARQ-ACK information for a PDSCH scheduled with NNK1

Online session conclusion [3]: Prepare TP(s) for clarification to remove unintended limitations on Type-3 HARQ-ACK codebook usage (when no NNK1 value was received, when the UE is configured with semi-static codebook) until 4/29.

# Text Proposal for issue B10

Proposal:

* Approve the TP#1 and TP#2-Alt2 below for TS 38.213

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| Reason for change | Specifications are unclear on whether type-3 HARQ-ACK codebook can be triggered when no DCI indicate a NNK1 (non-numerical K1) value of PDSCH-to-HARQ\_feedback timing field, and whether type-3 HARQ-ACK codebook can be used to report PDSCH scheduled with NNK1 value of PDSCH-to-HARQ\_feedback timing field when UE is configured with type-1 HARQ-ACK codebook. Clarify the UE behavior if DCI format 1\_1 simultaneously indicates a NNK1 value of PDSCH-to-HARQ\_feedback timing field and requests feedback of Type-3 HARQ-ACK codebook (one-shot HARQ-ACK request field with value 1). |
| Summary of changes | Clarify that Type-3 CB can be triggered and reported when no DCI indicated a NNK1 value NNK1 value of PDSCH-to-HARQ\_feedback timing field. Clarify that Type-3 CB can report HARQ-ACK information for a PDSCH scheduled with NNK1 value NNK1 value of PDSCH-to-HARQ\_feedback timing field when UE is configured with type-1 CB. Clarify that Type-1 CB cannot report HARQ-ACK information for a PDSCH scheduled with NNK1 value NNK1 value of PDSCH-to-HARQ\_feedback timing field. |
| Specs/Sections impacted | TS 38.213 sections 9.1 and 9.1.2 |
| Consequences if not approved | HARQ-ACK reporting from UE may be incorrect for a Type-1 HARQ-ACK codebook and for a Type-3 HARQ-ACK codebook. |

--------------------------------- Start of TP#1 for section 9.1 ---------------------------------------

**9.1 HARQ-ACK codebook determination**

If a UE is provided *pdsch-HARQ-ACK-Codebook-*List, the UE can be indicated by *pdsch-HARQ-ACK-Codebook-List* to generate one or two HARQ-ACK codebooks. If the UE is indicated to generate two HARQ-ACK codebooks

- a first HARQ-ACK codebook is associated with a PUCCH of priority index 0 and a second HARQ-ACK codebook is associated with a PUCCH of priority index 1

- the UE is provided first and second for each of {*PUCCH-Config*, *UCI-OnPUSCH*, *PDSCH*-*codeBlockGroupTransmission*} by {*PUCCHConfigurationList*, *UCI-OnPUSCH-List*, *PDSCH-CodeBlockGroupTransmission-List*}, respectively, for use with the first and second HARQ-ACK codebooks, respectively

If a UE receives a PDSCH without receiving a corresponding PDCCH, or if the UE receives a PDCCH indicating a SPS PDSCH release, the UE generates one corresponding HARQ-ACK information bit. If the UE generates two HARQ-ACK codebooks, the UE is indicated by *harq-CodebookID*, per SPS PDSCH configuration, a HARQ-ACK codebook index for multiplexing the corresponding HARQ-ACK information bit.

If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, and the UE detects a DCI format in any PDCCH monitoring occasion that 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 Subclause 9.1.4.

- the UE does not expect that the PDSCH-to-HARQ\_feedback timing indicator field of the DCI provides an inapplicable value from dl-DataToUL-ACK

--------------------------------- End of TP#1 for section 9.1 ---------------------------------------

--------------------------------- Start of TP#2-Alt1 for section 9.1.2 ---------------------------------------

**9.1.2 Type-1 HARQ-ACK codebook determination**

This clause applies if the UE is configured with *pdsch-HARQ-ACK-Codebook = semi-static*.

A UE reports HARQ-ACK information for a corresponding PDSCH reception or SPS PDSCH release only in a HARQ-ACK codebook that the UE transmits in a slot indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format 1\_0 or DCI format 1\_1. The UE reports NACK value(s) for HARQ-ACK information bit(s) in a HARQ-ACK codebook that the UE transmits in a slot not indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format 1\_0 or DCI format 1\_1.

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 is provided *pdsch-HARQ-ACK-OneShotFeedback-r16* andif the UE detects a second DCI format in any PDCCH monitoring occasion after the first one where the second DCI format includes a One-shot HARQ-ACK request field with value 1, the UE multiplexes the corresponding HARQ-ACK information in a PUCCH or PUSCH transmission in a slot that is indicated by the value of a PDSCH-to-HARQ\_feedback timing indicator field in the second DCI format. 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.

--------------------------------- End of TP#2-Alt1 for section 9.1.2 ---------------------------------------

--------------------------------- Start of TP#2-Alt2 for section 9.1.2 ---------------------------------------

**9.1.2 Type-1 HARQ-ACK codebook determination**

This clause applies if the UE is configured with *pdsch-HARQ-ACK-Codebook = semi-static*.

A UE reports HARQ-ACK information for a corresponding PDSCH reception or SPS PDSCH release only in a HARQ-ACK codebook that the UE transmits in a slot indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format 1\_0 or DCI format 1\_1. The UE reports NACK value(s) for HARQ-ACK information bit(s) in a HARQ-ACK codebook that the UE transmits in a slot not indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format 1\_0 or DCI format 1\_1.

If the UE is not provided pdsch-HARQ-ACK-OneShotFeedback-r16, the UE does not expect to receive a PDSCH scheduled by a DCI format that the UE detects in any PDCCH monitoring occasion and includes a PDSCH-to-HARQ\_feedback timing indicator field providing an inapplicable value from dl-DataToUL-ACK.

--------------------------------- End of TP#2-Alt2 for section 9.1.2 ---------------------------------------

# Companies comments

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| **Company** | **Comments** |
| QC | For 9.1, we also prefer to capture it as error case and have one paragraph as below:  If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, and the UE detects a DCI format in any PDCCH monitoring occasion that 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 Subclause 9.1.4.  - the UE does not expect that the PDSCH-to-HARQ\_feedback timing indicator field of the DCI provides an inapplicable value from dl-DataToUL-ACK |
| OPPO | In 9.1 there are now three TPs   1. If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, and the UE detects a DCI format in any PDCCH monitoring occasion that includes a One-shot HARQ-ACK request field with value 1 and a value of a PDSCH-to-HARQ\_feedback timing indicator field, the UE includes the HARQ-ACK information in a Type-3 HARQ-ACK codebook, as described in Subclause 9.1.4. 2. If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, and the UE detects a DCI format in any PDCCH monitoring occasion that includes a One-shot HARQ-ACK request field with value 1 and an applicable value of a PDSCH-to-HARQ\_feedback timing indicator field, the UE includes the HARQ-ACK information in a Type-3 HARQ-ACK codebook, as described in Subclause 9.1.4. 3. If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16* and the UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1, the UE expects that the PDSCH-to-HARQ\_feedback timing indicator field provides an applicable value from dl-DataToUL-ACK.   We think 1+3 is equal to 2. Therefore, we can either take 2 or 1+3. But not all. If we go with 1+3, QC’s amendment is better.  For TP in 9.1.2  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 is provided *pdsch-HARQ-ACK-OneShotFeedback-r16* andif the UE detects a second DCI format in any PDCCH monitoring occasion after the first one where the second DCI format includes a One-shot HARQ-ACK request field with value 1, the UE multiplexes the corresponding HARQ-ACK information in a PUCCH or PUSCH transmission in a slot that is indicated by the value of a PDSCH-to-HARQ\_feedback timing indicator field in the second DCI format. 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.  It is clear that the first bullet is already covered by TP in 9.1. For the second bullet, as explained many times, there is no mechanism to report HARQ-ACK info for PDSCH with NNK1 in type1-CB. With this TP, the UE won’t report the HARQ-ACK in type1-CB, without this TP, the UE won’t report the HARQ-ACK in type1-CB either. Thus TP in 9.1.2 is not needed. |
| Lenovo. Motorola Mobility | For 9.1, we think the first added paragraph are same thing. Some suggestions from our side are listed for reference:  If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, and the UE detects a DCI format in any PDCCH monitoring occasion that includes a One-shot HARQ-ACK request field with value 1 and a value of a PDSCH-to-HARQ\_feedback timing indicator field, the UE includes the HARQ-ACK information in a Type-3 HARQ-ACK codebook, as described in Subclause 9.1.4.  ~~If a UE is provided~~ *~~pdsch-HARQ-ACK-OneShotFeedback-r16~~*~~, and the UE detects a DCI format in any PDCCH monitoring occasion that 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 Subclause 9.1.4.~~  - the UE does not expect that the PDSCH-to-HARQ\_feedback timing indicator field of the DCI provides an inapplicable value from dl-DataToUL-ACK |
| Nokia, NSB | Prepare TP(s) for clarification to remove unintended limitations on Type-3 HARQ-ACK codebook usage (when no NNK1 value was received, when the UE is configured with semi-static codebook) until 4/29  In general we think nothing is needed in 9.1, but if companies insist, below can be added to 9.1.   The text in 9.1.2 we support. Applicable/inapplicable values is not in scope of this TP.  If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, and the UE detects a DCI format in any PDCCH monitoring occasion that includes a One-shot HARQ-ACK request field with value 1 and a value of a PDSCH-to-HARQ\_feedback timing indicator field, the UE includes the HARQ-ACK information in a Type-3 HARQ-ACK codebook, as described in Subclause 9.1.4. |
| Ericsson | * TP for 9.1:   We are fine with suggested TP in V3 (or based on QC proposal).  If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback-r16*, and the UE detects a DCI format in any PDCCH monitoring occasion that 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 Subclause 9.1.4.  - the UE does not expect that the PDSCH-to-HARQ\_feedback timing indicator field of the DCI provides an inapplicable value from dl-DataToUL-ACK   * TP for 9.1.2   As I indicated earlier, I agree with OPPO technically, that the TP is not needed. If there is strong objection, we are fine not to have it.  However, although the code takes care of that, it would be useful for implementation to provide a clear text in the spec, to avoid unnecessary problems. Please note that a similar text is provided for enhanced/dynamic CB. Hence, since such a text is absent for semi-static, it would not be clear whether it is supported or not, until the code is executed. And during testing, if this case is mistakenly considered, could potentially end up in an costly bug fixing. |

# References

1. R1-2002696 Feature lead summary#1 on NR-U HARQ, RAN1#100b-e
2. R1-2002922 Feature lead summary#1 on email discussion 100b-e-NR-unlic-NRU-HARQ-01 (Type-3 HARQ-ACK codebook)
3. R1-2002924 Feature lead summary#1 on email discussion 100b-e-NR-unlic-NRU-HARQ-03 (SPS)
4. Chairman's Notes RAN1#100b-e 7.2.2 v006, RAN1#100bis-e GTW session notes