**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: Draft TPs for NRU HARQ Issue A9**

**Document for: Discussion and Decision**

# Introduction

This document provides TP proposals on issue A9 based on proposals (pending approval) in [2].

[100b-e-NR-unlic-NRU-HARQ-02] Email discussion/approval on following issues related to Type-2 enhanced HARQ-ACK codebook by 4/24; if necessary, followed by endorsing the corresponding TPs by 4/30 – David (Huawei)

* A9: How to determine NFI, number of requested groups and PUCCH occasions i(g) and i((g+1) mod 2) when multiple DCIs provide these values

# TPs

**Issue A9: TS38.213 clause 9.1.3.3: how to determine NFI, number of requested groups, PUCCH occasions i(g) and i((g+1)mod2) when multiple DCIs provide these values**

Proposal 2:

* The 1 MSB bit is the NFI for the scheduled PDSCH group, and the 1 LSB bit is the NFI for the non-scheduled PDSCH group.
	+ Develop a TP by 4/28

**TP#1 for 38.212 v16.1.10**

Reason for change: to specify how the 2 bits of the New feedback indicator DCI field are mapped to the scheduled group or the non-scheduled group as defined in TS38.213 clause 9.1.3.3.

================== Beginning of text proposal 1 ===================

**7.3.1.2.2 Format 1\_1**

DCI format 1\_1 is used for the scheduling of PDSCH in one cell.

\*\*\* Unchanged text omitted \*\*\*

- New feedback indicator – 0, 1 or 2 bits.

- 1 bit if the higher layer parameter *pdsch-HARQ-ACK-Codebook = enhancedDynamic-r16* and the higher layer parameter *NFI-TotalDAI-Included-r16* is not configured;

- 2 bits if the higher layer parameter *pdsch-HARQ-ACK-Codebook = enhancedDynamic-r16* and the higher layer parameter *NFI-TotalDAI-Included-r16 = enable*; the MSB corresponds to the scheduled PDSCH group, and the LSB corresponds to the non-scheduled PDSCH group, as defined in [TS38.213] clause 9.1.3.3;

- 0 bit otherwise.

================== End of text proposal 1 ===================

Proposal 3:

* It is not expected to receive DCIs with q=0 pointing to the same PUCCH transmission occasion for different PDSCH groups

Proposal 6:

* If a first DCI format scheduling PDSCH reception and providing the first indication for a PUCCH transmission occasion in a slot does not include a New\_Feedback indicator field, the value of h(g) for this PDSCH reception is set only if h(g) is provided by another DCI format providing a value of h(g), and the same value of g and a value of k indicating the same PUCCH transmission occasion in the slot. This first DCI determines m=0.

Proposal 7:

* Clarify that g (scheduled group) and q (number of requested groups) are obtained from the last non-fallback DCI format 1\_1 providing these values for a PUCCH transmission occasion

**TP#2 for 38.213 v16.1.10**

Reason for change: when the UE is provided *pdsch-HARQ-ACK-Codebook = enhancedDynamic-r16:* correct how to determine NFI for a DCI format 1\_0 and correct how the first PDCCH monitoring occasion for type-2 HARQ-ACK codebook is determined when the first DCI providing a slot for a PUCCH transmission occasion is a DCI format 1\_0. Clarify that g (scheduled group) and q (number of requested groups) are obtained from the last non-fallback DCI format 1\_1 providing these values for a PUCCH transmission occasion. Clarify that a UE is not expected to receive DCIs with q=0 pointing to the same PUCCH transmission occasion for different PDSCH groups.

================== Beginning of text proposal 2 ===================

**9.1.3.3 Type-2 HARQ-ACK codebook grouping and HARQ-ACK retransmission**

If a UE is provided *pdsch-HARQ-ACK-Codebook = enhancedDynamic-r16*, the UE determines HARQ-ACK information for multiplexing in a PUCCH transmission occasion according to the following procedure.

Set to the value of a PDSCH group index field in the last DCI format that provides a value of *g* for the PUCCH transmission occasion.

Set to denote a PUCCH transmission occasion for multiplexing HARQ-ACK information

Set to the value of a PDSCH-to-HARQ\_feedback timing field, if any, in a DCI format providing a value of . If the DCI format does not include a PDSCH-to-HARQ\_feedback timing field, set to the value provided by *dl-DataToUL-ACK*

Set to the value of a first New\_Feedback indicator field, if any, in a DCI format providing a value of

Set to a value of a second New\_Feedback indicator field, if any, in a DCI format providing a value of

Set to the value of a total DAI field for group , if any, in a DCI format providing a value of

Set to the value of a number of requested PDSCH group(s) field, in the last DCI format providing the value of q for the PUCCH transmission occasion.

A UE is not expected to generate HARQ-ACK information if the UE received DCI formats indicating *Number of requested PDSCH group(s) =* 0 if the received DCI formats correspond to the same PUCCH transmission occasion and the received DCI formats indicate different values for the *PDSCH group index* field.

If a first DCI format scheduling PDSCH reception and providing the first indication for a PUCCH transmission occasion in a slot does not include a New\_Feedback indicator field, the value of *h*(*g*) for this PDSCH reception is set only if *h*(*g*) is provided by another DCI format providing a value of *h*(*g*) for *g* = 0 and a value of *k* indicating the same PUCCH transmission occasion in the slot.

Generate first HARQ-ACK information for PUCCH transmission occasion in a slot, as described in Clause 9.1.3.1, where

- the first HARQ-ACK information corresponds only to detections of DCI formats each providing a same value of , of , and to detections of DCI formats not providing a value of g and h(g) but each associated with a same value of g, of h(g), and at least one of the DCI formats providing a value of indicating the slot

- 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 g, 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

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 not providing a value of , of , but each 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 for both sub-codebooks, if any.

If and , generate second HARQ-ACK information, as described in Clause 9.1.3.1, by setting for all and all and, after the completion of the and loops for the pseudo-code for the second HARQ-ACK codebook generation in Clause 9.1.3.1, setting .

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

--Unchanged part 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 ,

* if 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.
* Otherwise, the UE assumes PDSCH group index 0 for a PDSCH reception scheduled by detections of DCI format 1\_0.

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

================== End of text proposal 2 ===================

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| **Company** | **Comments** |
| QC | For TP#2:Comment 1: The last DCI should be defined, i.e., among which DCIs? We suggest the following (including some editorial suggestions):Set to the value of a PDSCH group index field in a last DCI format that provides a value of *g* among the DCI formats that indicate a same slot for a PUCCH transmission occasionComment 2: Once this last DCI format is defined, the other values should be based on that. Also, “if any” is not needed for the case of h(g) as that DCI format always indicates NFI for the group. Hence, we suggest:Set to the value of a first New\_Feedback indicator field, in the last DCI format providing the value of Set to a value of a second New\_Feedback indicator field, if any, in the last DCI format providing the value of Set to the value of a total DAI field for group , if any, in the last DCI format providing the value of Set to the value of a number of requested PDSCH group(s) field, in the last DCI format providing the value of g .Comment 3: For , we should be careful when the last DCI format providing the value of g (as determined above) is not the absolute last DCI (which means the absolute last DCI is a fallback DCI). Then there are 2 cases:* Case 1: g=0. In this case, there is no issue
* Case 2: g=1. In this case, should be set to empty and should not be used (since DAI is updated in absolute last DCI that is a fallback DCI associated with group 0). If we do not do that, then codebook construction will be wrong for the second HARQ-Ack information, i.e., in the following part “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.”

Based on above, we suggest the following:Set to the value of a total DAI field for group , if any, in the last DCI format providing the value of . If and a DCI formats not including a PDSCH group index field is detected after the last DCI format providing the value of and indicating the same slot for the PUCCH transmission occasion, set .Comment 4: For proposal 6, we have the following editorial suggestions to simplify (also g, h(g) , etc. is for a DCI format in the rest of the section and not for a PDSCH repletion)If a first DCI format indicating a slot for a PUCCH transmission occasion does not include a New\_Feedback indicator field, the value of *h*(*g*) for the first DCI format is set only if *h*(*g*) is provided by another DCI format providing a value of *h*(*g*) for *g* = 0 and indicating the same slot for the PUCCH transmission occasion.Also, perhaps this text above can be added to the second part of the TP where other assumptions about fallback DCI is explained.  |
| MediaTek | * On TP for Proposal 2: We support the TP from FL

On TP for Proposal 3: Agree with FL’s and Nokia’s comment that spec should avoid ambiguous signaling. Thus, we suggest the following TP for proposal 3:

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| If a UE detects DCI formats with respective PDSCH-to-HARQ\_feedback timing field values indicating a same PUCCH transmission occasion and if the DCI formats indicate different values of the *PDSCH group index field*, the UE does not expect that none of the DCI formats indicates *Number of requested PDSCH group(s) =*1. |

* On TP for Proposal 6: Do we preclude DCI 1\_0 to indicate DLSPS release when eType2 codebook is configured? If not, we suggest the following changes:

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| If a first DCI format providing the first indication for a PUCCH transmission occasion in a slot does not include a New\_Feedback indicator field, the value of *h*(*g*) associating with the DCI format is set only if *h*(*g*) is provided by another DCI format providing a value of *h*(*g*) for *g* = 0 and a value of *k* indicating the same PUCCH transmission occasion in the slot. |

However, if common understanding is DLSPS release is not included, I am fine with this TP.* On TP for Proposal 7: Prefer to more clearly specify how to determine the last DCI that provides a value of g or q for the PUCCH transmission occasion
	+ The last DCI with a respective PDSCH-to-HARQ\_feedback timing field value indicating the PUCCH transmission occasion
	+ The last DCI provides a value of g or q in a corresponding field of the DCI

Thus, we suggest the following TP for proposal 7:

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| Set to the value of a PDSCH group index field in the last DCI format that provides a value of *g* and a value of PDSCH-to-HARQ\_feedback timing field indicating the PUCCH transmission occasion.Set to the value of a number of requested PDSCH group(s) field, in the last DCI format providing the value of q and a value of PDSCH-to-HARQ\_feedback timing field indicating the PUCCH transmission occasion. |

On the end of TP: I am a bit puzzled about the TP. According to the condition, if there is no DCI format is DCI format 1\_0, then the UE assumes PDSCH group index 0 for a PDSCH reception scheduled by detections of DCI format 1\_0. However, none of the detected DCIs is format 1\_0. |
| vivo | * On TP for Proposal 2: We support the TP from FL.
* On TP for Proposal 3: We share the same view as MediaTek.
* On TP for Proposal 6: Agree with QC and MediaTek. DCI 1\_0 indicating DL SPS release when eType2 codebook is configured should also be involved.
* On TP for Proposal 7: Either QC's and MediaTek's update is OK. The set of DCI formats should be clarified.
* On the end of TP: We have the same concern as MediaTek. Maybe the condition for 'if' should be changed to 'none of the DCI formats that the UE detects after a last PUCCH transmission occasion for g=0 includes a New\_Feedback indicator field for g=0'.
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# References

1. R1-2002696 Feature lead summary#1 on NR-U HARQ, RAN1#100b-e
2. R1-2002923 Feature lead summary#1 on email discussion 100b-e-NR-unlic-NRU-HARQ-02