**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 $g$ 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 $i(g)$ to denote a PUCCH transmission occasion for multiplexing HARQ-ACK information

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

Set $h(g)$ to the value of a first New\_Feedback indicator field, if any, in a DCI format providing a value of $g$

Set $h^{\left(g+1\right)mod2}(g)$ to a value of a second New\_Feedback indicator field, if any, in a DCI format providing a value of $g$

Set $V\_{DAI}^{\left(g+1\right)mod2}$ to the value of a total DAI field for group $\left(g+1\right)mod2$, if any, in a DCI format providing a value of $g$

Set $q$ 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 $i(g)$ 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 $g$, of $h(g)$, 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 $k$ indicating the slot

- at least one of the DCI formats provides a $h(g)$ value

- $m=0$ corresponds to a PDCCH monitoring occasion, where the UE detects a DCI format that provides a value of $g$ 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 $h(g)$

If $h^{\left(g+1\right)mod2}\left(g\right)=∅$ or $h^{\left(g+1\right)mod2}\left(g\right)=h(\left(g+1\right)mod2)$, generate second HARQ-ACK information for PUCCH transmission occasion $i(\left(g+1\right)mod2)$ 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 $\left(g+1\right)mod2$, of $h(\left(g+1\right)mod2)$, and to detections of DCI formats not providing a value of $\left(g+1\right)mod2$, of $h(\left(g+1\right)mod2)$, but each associated with a same value of $\left(\right)$, of $h(\left(g+1\right)mod2)$,

- at least one of the DCI formats provides a $h(\left(g+1\right)mod2)$ value

- $m=0$ corresponds to a PDCCH monitoring occasion, where the UE detects a DCI format that provides a value of $\left(g+1\right)mod2$ or that is associated with a value of $\left(\right)$, 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 $h(\left(g+1\right)mod2)$

- the PUCCH transmission occasion $i(\left(g+1\right)mod2)$ is a last one for multiplexing second HARQ-ACK information and it is not after PUCCH transmission occasion $i(g)$

- if $V\_{DAI}^{\left(g+1\right)mod2}\ne ∅$, after the completion of the $c$ and $m$ loops for the pseudo-code for the second HARQ-ACK codebook generation in Clause 9.1.3.1, set $V\_{temp2}=V\_{DAI}^{\left(g+1\right)mod2}$ for both sub-codebooks, if any.

If $h^{\left(g+1\right)mod2}\left(g\right)\ne ∅$ and $h^{\left(g+1\right)mod2}\left(g\right)\ne h(\left(g+1\right)mod2)$, generate second HARQ-ACK information, as described in Clause 9.1.3.1, by setting $V\_{C-DAI,c,m}^{DL}=0$ for all $c$ and all $m$ and, after the completion of the $c$ and $m$ loops for the pseudo-code for the second HARQ-ACK codebook generation in Clause 9.1.3.1, setting $V\_{temp2}=V\_{DAI}^{\left(g+1\right)mod2}$.

If $q=0$, the UE

includes only the first HARQ-ACK information for multiplexing in PUCCH transmission occasion $i(g)$

elseif $q=1$

if g = 1

appends the first HARQ-ACK information to the second HARQ-ACK information for multiplexing in PUCCH transmission occasion $i(g)$

else

append the second HARQ-ACK information to the first HARQ-ACK information for multiplexing in PUCCH transmission occasion $i(g)$

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 $g=0$ includes a New\_Feedback indicator field for $g=0$,

* 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** |
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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