**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 A11 (SPS)**

**Document for: Discussion and Decision**

# Introduction

This document provides TP proposals on issue A11 based on proposal 1 and 2 in [2]. It is proposed to handle the TP corresponding to “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)” with the TP for issue B10 in email discussion [100b-e-NR-unlic-NRU-HARQ-01].

[100b-e-NR-unlic-NRU-HARQ-03] Email discussion/approval on handling of SPS with enhanced dynamic codebook and with NNK1 by 4/24; if necessary, followed by endorsing the corresponding TPs by 4/30 – David (Huawei)

Agreement:

The HARQ-ACK bit(s) corresponding to SPS PDSCH is(are) appended to the end of a dynamic HARQ-ACK codebook with PDSCH grouping, without belonging to any group.

Develop TP by 4/29

Proposal:

* DCI format 1\_1 should not simultaneously indicate a NNK1 value and activate a SPS configuration (CRC scrambled with CS-RNTI and NDI=0)
* 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)

Develop corresponding TP(s) until 4/28.

Agreement:

It is clarified that in a DCI activating SPS PDSCH, the NFI, DAI, q fields are only interpreted for the PDSCH scheduled by the DCI and are not interpreted for the SPS PDSCHs.

* No TP is needed

# Updated proposal for A11

Proposal 2:

* DCI format 1\_1 should not simultaneously indicate a NNK1 value and activate a SPS configuration (CRC scrambled with CS-RNTI and NDI=0)
* 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)
* 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

# Text proposal for A11

**TP#1-Alt1 (TS 38.213 v16.1.0)**

|  |  |
| --- | --- |
| Reason for change | Clarify how HARQ-ACK information for SPS PDSCH is reported in a Type-2 HARQ-ACK codebook when the UE is provided pdsch-HARQ-ACK-Codebook = enhancedDynamic-r16 |
| Summary of changes | Clarify that HARQ-ACK information for SPS PDSCH is generated separately from first and second HARQ-ACK information in case of PDSCH grouping, and appended at the end of the first HARQ-ACK information. |
| Specs/Sections impacted | TS 38.213 v16.1.0 section 9.1.3.3 |
| Consequences if not approved | HARQ-ACK information for SPS PDSCH may be reported twice in a Type-2 HARQ-ACK codebook, or may not be reported by the UE as expected by the network. |

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

**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.

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

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 , if any, 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 , 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 generation of the first HARQ-ACK information for PUCCH transmission occasion in a slot, as described in Clause 9.1.3.1, includes the generation of HARQ-ACK information for DL SPS PDSCH.

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 , if any

- 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 , 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 .

The generation of the second HARQ-ACK information for PUCCH transmission occasion in a slot, as described in Clause 9.1.3.1, excludes the generation of HARQ-ACK information for DL SPS PDSCH.

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

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

**TP#1-Alt2 (TS 38.213 v16.1.0)**

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| --- | --- |
| Reason for change | Clarify how HARQ-ACK information for SPS PDSCH is reported in a Type-2 HARQ-ACK codebook when the UE is provided pdsch-HARQ-ACK-Codebook = enhancedDynamic-r16 |
| Summary of changes | Clarify that HARQ-ACK information for SPS PDSCH is generated separately from first and second HARQ-ACK information in case of PDSCH grouping, and appended at the end of the first and second HARQ-ACK information. |
| Specs/Sections impacted | TS 38.213 v16.1.0 section 9.1.3.3 |
| Consequences if not approved | HARQ-ACK information for SPS PDSCH may be reported twice in a Type-2 HARQ-ACK codebook, or may not be reported by the UE as expected by the network. |

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

**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.

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

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 , if any, 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 , 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 generation of the first HARQ-ACK information for PUCCH transmission occasion in a slot, as described in Clause 9.1.3.1, excludes the generation of HARQ-ACK information for DL SPS PDSCH.

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 , if any

- 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 , 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 .

The generation of the second HARQ-ACK information for PUCCH transmission occasion in a slot, as described in Clause 9.1.3.1, excludes the generation of HARQ-ACK information for DL SPS PDSCH.

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

The UE appends the HARQ-ACK information corresponding to DL SPS PDSCH reception, if any, as described in Clause 9.1.3.1, after the first and second (if any) HARQ-ACK information.

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

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

**TP#2 (TS 38.213 v16.1.0)**

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| --- | --- |
| Reason for change | Clarify the UE behavior if DCI format 1\_1 simultaneously indicates a NNK1 value and activates a SPS configuration |
| Summary of changes | Clarify that the UE should not expect to receive an inapplicable value of PDSCH-to-HARQ\_feedback timing indicator field if DCI format 1\_1 activates a SPS configuration |
| Specs/Sections impacted | TS 38.213 v16.1.0 section 10.2 |
| Consequences if not approved | The UE would not be able to report HARQ-ACK information for an SPS activation |

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

**10.2 PDCCH validation for DL SPS and UL grant Type 2**

A UE validates, for scheduling activation or scheduling release, a DL SPS assignment PDCCH or 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'.

- the PDSCH-to-HARQ\_feedback timing indicator field does not provide an inapplicable value from *dl-DataToUL-ACK*

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

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

# Companies comments

|  |  |
| --- | --- |
| **Company** | **Comments** |
| OPPO | TP#1 does not seem to capture the following agreement  Agreement:  The HARQ-ACK bit(s) corresponding to SPS PDSCH is(are) appended to the end of a dynamic HARQ-ACK codebook with PDSCH grouping, without belonging to any group. |
| QC | Agree with the TP. Our understanding is that the agreement above does not mean that HARQ-Ack for SPS should be at the very end. We have been discussing the same issue in the Email tread and there was no consensus on placing HARQ-Ack at the very end. We do not see any technical issue with the TP. If it is placed at the very end, does it mean that even Rel. 15 should change for the case of TB-based and CBG-based sub-codebooks? |
| LG | As already commented and according to the agreement, TP#1 need to be revised as below, to avoid irregular arrangement of HARQ-ACK bits not based on group index.  The generation of the first HARQ-ACK information for PUCCH transmission occasion in a slot, as described in Clause 9.1.3.1, excludes the generation of HARQ-ACK information for DL SPS PDSCH.  […]  The generation of the second HARQ-ACK information for PUCCH transmission occasion in a slot, as described in Clause 9.1.3.1, excludes the generation of HARQ-ACK information for DL SPS PDSCH.  Generate the HARQ-ACK information corresponding to DL SPS PDSCH reception, if any, as described in Clause 9.1.3.1.  Regarding QC’s comment, in Rel-15, we only had the level of TB and CBG in a HARQ-ACK codebook, and thus, HARQ-ACK for SPS is mapped to TB sub-codebook since the SPS PDSCH is TB-based transmission.  But now, we newly have the upper level of group index then TB/CBG level belongs to each of group indexes, on the other hand, SPS PDSCH doesn’t belong to any group index. In this context, logically, HARQ-ACK needs to be mapped TB/CBG level first then group index second. Given that, the HARQ-ACK for SPS PDSCH not belonging to any group index is to be mapped to the end of whole codebook. |
| ZTE | We are fine with the current TP#1. And we share the same view as FL that the agreement does not say it is appended to the end of first codebook or the second codebook.  For TP#2, it seems that the condition for SPS release is still FFS. Perhaps it is better to have separate paragraphs respectively for the activation and release?  FFS: DCI format 1\_1 should not simultaneously indicate a NNK1 value and indicate SPS release. |
| Lenovo, Motorola Mobility | We support the HARQ-ACK feedback for SPS PDSCH is appended at the end of the whole HARQ-ACK codebook, without belonging to any PDSCH group. If companies think current agreement has not captured this point, clarification is needed.  Our understanding on HARQ-ACK codebook is:  -             A/N for group 0 (including TB-based A/N bits and CBG-based A/N bits if any) + A/N for group 1 (including TB-based A/N bits and CBG-based A/N bits if any) + A/N for SPS PDSCH |
| Ericsson | We share the same view as LG. The changes suggested by LG seems reasonable to us. Also, our understanding from the agreement is similar to Lenovo and LG. However, if there is an ambiguity for that and a risk for unnecessary deviating from Rel-15 behavior, we would prefer to discuss that and reach a common understanding. |

# References

1. R1-2002696 Feature lead summary#1 on NR-U HARQ, RAN1#100b-e
2. R1-2002924 Feature lead summary#1 on email discussion 100b-e-NR-unlic-NRU-HARQ-03 (SPS)
3. Chairman's Notes RAN1#100b-e 7.2.2 v009