**3GPP TSG RAN WG1 #117** **R1-240xxxx**

**Fukuoka, Japan, May 19th – 24th, 2024**

**Agenda item:** 7

**Source:** Samsung

**Title:** Summary of discussion on Type-2 HARQ-ACK codebook and DL BWP change

**Document for:** Discussion and decision

# Introduction

This document aims to collect opinions on the draft CR in [1] (continuation of the discussions from RAN1#116bis) for clarifying the pseudo-code for the Type-2 HARQ-ACK codebook generation in association with DL/UL BWP change. The changes are to:

1. Clarify that PUCCH transmission is after DL/UL BWP change,
2. Clarify that the trigger condition is for the same DL BWP change (i.e. change “an” to “the”).

A background for related RAN1 agreements and progression of specifications on the topic is provided in [2]. The motivation for the draft CR is to:

1. Correctly capture respective RAN1 agreements
2. Align the descriptions for Type-1 and Type-2 HARQ-ACK codebooks with respect to DL/UL BWP change (current descriptions for the Type-1 HARQ-ACK codebook are according to the draft CR)
3. Have meaningful text in the specifications (current text may even be interpreted as a UE never reporting HARQ-ACK if there would be a future UL/DL BWP change)

# Discussion

Please provide your comments on the draft CR in [1] in the following table. For easier reference, the text of the draft CR is included below.

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| **Company** | **Comment** |
| MTK | The proposed draft CR is also our understanding for current spec so we are fine with the CR. |
| Qualcomm | Thanks for the effort on this issue.  We think this is not an essential issue that needs to be resolved as a CR for legacy release given NBC risks. Further, RAN1 made following conclusions in the past and hence, we are not sure how the CR can resolve any ambiguities.   |  | | --- | | [**R1-1910312**](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_98b\R1-1910312.zip) Discussion on HARQ-ACK codebook determination with BWP switch CATT  Discuss further offline in combination with draft CR1 in x1413  **Conclusion**:   * For type-2 HARQ-ACK codebook, for the issue raised in R1-1910312, the UE behaviour is not defined   + No CR is necessary   For type-1 HARQ codebook issue – **R1-1911624**  **Conclusion:**   * For Type-1 HARQ-ACK codebook, if the HARQ-ACK codebook size is changed due to BWP switching, the UE behaviour for the HARQ-ACK transmission is not defined.   Check till RAN1#99 whether or not to have a CR  [**R1-1912142**](file:///C:\Users\ktakeda\AppData\Local\Docs\R1-1912142.zip) Correction on HARQ-ACK codebook determination with BWP switch CATT  **Conclusion:**   * For Type-1 HARQ-ACK codebook, if the HARQ-ACK information bit(s) and/or the PUCCH resource for the HARQ-ACK feedback is impacted due to BWP switching, the UE behavior for the HARQ-ACK transmission is not defined. | |
| Moderator | After offline discussion with Qualcomm, the text of the draft CR is updated to include slot-based granularity for the “after” of the PUCCH transmission and the DL/UL BWP change in the following text for clause 9.1.3.1. The reasoning from Qualcomm is that the DL BWP change can be on a cell with different SCS than the cell for the PUCCH transmission (e.g. the PCell).  Although it may be argued that it is sufficient for the PUCCH transmission to be after the DL/UL BWP change, even if the slot when the DL/UL BWP change happens overlaps with the slot of the PUCCH transmission, the additional restriction for the slot of the PUCCH transmission to be after the slot of the DL/UL BWP switch is rather mild and can help close the discussion on this issue.  Two additional notes:   1. The CR would be for Rel-18. 2. The CR does not affect the conclusion from the discussions for [R1-1910312](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_98b\R1-1910312.zip) in RAN1#98bis. |
| Huawei, HiSilicon | Thank you very much for the update. However, we have concern on the updated version, since it basically means that when the DL/UL BWP change happens overlaps with the slot of the PUCCH transmission, even if the BWP switching is done before the PUCCH transmission, UE needs to feedback the HARQ-ACK, which is not aligned with the agreements. We prefer the original wording, if we really have to modify, we can accept to change ‘after’ to ‘not before’ as below:  and the PUCCH transmission is in a slot that is ~~after~~ not before the slot of active DL BWP change or the slot of active UL BWP change |
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| 9.1.3.1 Type-2 HARQ-ACK codebook in physical uplink control channel \*\*\* Unchanged parts are omitted \*\*\*  If the UE transmits HARQ-ACK information in a PUCCH in slot  and for any PUCCH format, the UE determines the , for a total number of  HARQ-ACK information bits, according to the following pseudo-code:  Set  – PDCCH with DCI format 1\_0 or DCI format 1\_1 monitoring occasion index: lower index corresponds to earlier PDCCH with DCI format 1\_0 or DCI format 1\_1 monitoring occasion  Set  Set  Set  Set  Set  to the number of serving cells configured by higher layers for the UE  Set  to the number of PDCCH monitoring occasion(s)  while  Set  – serving cell index: lower indexes correspond to lower RRC indexes of corresponding cell  while  if PDCCH monitoring occasion  is before an active DL BWP change on serving cell  or an active UL BWP change on the PCell and the active DL BWP change is not triggered by a DCI format 1\_1 in PDCCH monitoring occasion , and the PUCCH transmission is in a slot that is after the slot of active DL BWP change or the slot of active UL BWP change  ;  else  if there is a PDSCH on serving cell  associated with PDCCH in PDCCH monitoring occasion , or there is a PDCCH indicating SPS PDSCH release on serving cell  if  \*\*\* Unchanged parts are omitted \*\*\* |

# References

[1] [R1-2404069](file:///F:\3GPP\RAN1\Docs\R1-2400701.zip) Draft CR on HARQ-ACK skipping for BWP switching Samsung

[2] [R1-2404070](file:///F:\3GPP\RAN1\Docs\R1-2400702.zip) Discussion on HARQ-ACK skipping for BWP switching Samsung