**3GPP TSG RAN WG1 #106e R1-** **210xxxx**

**August 16th – 27th, 2021**

**Agenda item:** 7.2.5

**Source:** Moderator (Qualcomm)

**Title:** Summary of [106-e-NR-L1enh-URLLC-14] Discussion on Two PUCCH Capability

**Document for:** Discussion and Decision

# 1 Introduction

This document presents the companies proposals and discussions regarding the following email discussion:

* [106-e-NR-L1enh-URLLC-14] Discussion on two PUCCH capability (R1-2106407) by August 25 – Kianoush (Qualcomm)

In [1], RAN1 asked RAN2 whether the following statements for a UE configured with two slot-based HARQ codebooks are misplaced:

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| --- |
| ***twoPUCCH-Type5-r16***  Indicates whether the UE supports two PUCCH of format 0 or 2 for two HARQ-ACK codebooks with one 7\*2-symbol subslot based HARQ-ACK codebook. When simultaneously configured with two slot-based HARQ-ACK codebooks, the capability for each HARQ-ACK codebook is subjected to the capability reported by *twoPUCCH-F0-2-ConsecSymbols.*  ***twoPUCCH-Type6-r16***  Indicates whether the UE supports two PUCCH of format 0 or 2 in consecutive symbols for two HARQ-ACK codebooks with one 2\*7-symbol subslot based HARQ-ACK codebook. When simultaneously configured with two slot-based HARQ-ACK codebooks, the capability for each HARQ-ACK codebook is subjected to the capability reported by twoPUCCH-F0-2-ConsecSymbols.  ***twoPUCCH-Type8-r16***  Indicates whether the UE supports one PUCCH format 0 or 2 and one PUCCH format 1, 3 or 4 in the same subslot for HARQ-ACK codebooks with one 2\*7-symbol subslot based HARQ-ACK codebook. When simultaneously configured with two slot-based HARQ-ACK codebooks, the capability for each HARQ-ACK codebook is subjected to the capability reported by onePUCCH-LongAndShortFormat.  ***twoPUCCH-Type10-r16***  Indicates whether the UE supports two PUCCH transmissions in the same subslot for two HARQ-ACK codebooks with one 2\*7-symbol subslot which are not covered by *twoPUCCH-Type5-r16* and *twoPUCCH-Type7-r16*. When simultaneously configured with two slot-based HARQ-ACK codebooks, the capability for each HARQ-ACK codebook is subjected to the capability reported by *twoPUCCH-AnyOthersInSlot.* |

In [2], RAN2 responded with the following modifications:

| ***twoHARQ-ACK-Codebook-type1-r16***  Indicates whether the UE supports two HARQ-ACK codebooks with up to one subslot based HARQ-ACK codebook (i.e. slot-based + slot-based, or slot-based + subslot based) simultaneously constructed for supporting HARQ-ACK codebooks with different priorities at a UE. The capability signalling comprises the following parameters:  -     *sub-SlotConfig-NCP-r16* indicates the maximum number of actual PUCCH transmissions for HARQ-ACK within a slot for NCP with 2-symbol\*7 sub-slot configuration;  -     *sub-SlotConfig-ECP-r16* indicates the maximum number of actual PUCCH transmissions for HARQ-ACK within a slot for ECP with 2-symbol\*6 sub-slot configuration;  For the 7-symbol\*2 sub-slot configuration of NCP or the 6-symbol\*2 sub-slot configuration of ECP, the value of the maximum number of actual PUCCH transmissions for HARQ-ACK within a slot is {2}.  NOTE 1:   If the UE indicates support of this feature and is simultaneously configured with two slot-based HARQ-ACK codebooks:   * whether the UE supports two PUCCH of format 0 or 2 for each HARQ-ACK codebook is subjected to the capability reported by *twoPUCCH-F0-2-ConsecSymbols.* * whether the UE supports two PUCCH of format 0 or 2 in consecutive symbols for each HARQ-ACK codebook is subjected to the capability reported by *twoPUCCH-F0-2-ConsecSymbols.* * whether the UE supports one PUCCH format 0 or 2 and one PUCCH format 1, 3 or 4 in the same subslot for each HARQ-ACK codebook is subjected to the capability reported by *onePUCCH-LongAndShortFormat*. * whether the UE supports two PUCCH transmissions in the same subslot for each HARQ-ACK codebook is subjected to the capability reported by *twoPUCCH-AnyOthersInSlot.*     NOTE 2:   If a UE reports both *multiPUCCH-r16* and *twoHARQ-ACK-Codebook-type1-r16*, it can support two slot-based HARQ-ACK codebooks, and one slot-based and one-sub-slot-based HARQ-ACK codebooks. If a UE reports *twoHARQ-ACK-Codebook-type1-r16* but does not report *multiPUCCH-r16*, it can only support two slot-based HARQ-ACK codebooks. | FS | No | N/A | N/A |
| --- | --- | --- | --- | --- |

# 2 First Round of Discussions

This section summarizes the inputs from the companies on the potential edits required for NOTE 1 of *twoHARQ-ACK-Codebook-type1-r16* UE feature*.*

**Question 1: Do you agree that in the following two statements, “subslot” should be replaced by “slot”?**

* whether the UE supports one PUCCH format 0 or 2 and one PUCCH format 1, 3 or 4 in the same subslot for each HARQ-ACK codebook is subjected to the capability reported by *onePUCCH-LongAndShortFormat*.
* whether the UE supports two PUCCH transmissions in the same subslot for each HARQ-ACK codebook is subjected to the capability reported by *twoPUCCH-AnyOthersInSlot.*

|  |  |
| --- | --- |
| Company | Comment |
| Apple | Agree |
| Ericsson | Agree |

**Question 2: Do you agree that the first and the second sub-bullets are duplicated and keeping only the second one is sufficient?**

|  |  |
| --- | --- |
| Company | Comment |
| Apple | Agree |
| Ericsson | Agree |

**Question 3: Do you agree to update the second sub-bullet (and the first sub-bullet in case it is kept) as follows:**

* whether the UE supports two PUCCH of format 0 or 2 for each HARQ-ACK codebook in the same slot is subjected to the capability reported by *twoPUCCH-F0-2-ConsecSymbols.*
* whether the UE supports two PUCCH of format 0 or 2 in consecutive symbols for each HARQ-ACK codebook in the same slot is subjected to the capability reported by *twoPUCCH-F0-2-ConsecSymbols.*

|  |  |
| --- | --- |
| Company | Comment |
| Apple | Agree |
| Ericsson | Agree |

**Question 4: Do you think any other modification is needed? Please share your view in the table below.**

|  |  |
| --- | --- |
| Company | Comment |
| Apple | We would like to propose an additional change to the last sub-bullet to avoid any potential confusion:   * whether the UE supports two PUCCH transmissions in the same ~~sub~~slot for each HARQ-ACK codebook not covered by *twoPUCCH-F0-2-ConsecSymbols* and *onePUCCH-LongAndShortFormat* is subjected to the capability reported by *twoPUCCH-AnyOthersInSlot.* |
| Ericsson | 1. We think the existing sentences incorrectly describe “two PUCCH … for each HARQ-ACK codebook …”. The following changes are suggested for below:  * whether the UE supports two PUCCH of format 0 or 2, one PUCCH for each HARQ-ACK codebook, in the same slot is subjected to the capability reported by *twoPUCCH-F0-2-ConsecSymbols.* * whether the UE supports two PUCCH of format 0 or 2 in consecutive symbols, one PUCCH for each HARQ-ACK codebook, in the same slot is subjected to the capability reported by *twoPUCCH-F0-2-ConsecSymbols.* * whether the UE supports one PUCCH format 0 or 2 and one PUCCH format 1, 3 or 4 in the same slot, one PUCCH for each HARQ-ACK codebook, is subjected to the capability reported by *onePUCCH-LongAndShortFormat*. * whether the UE supports two PUCCH transmissions in the same slot, one PUCCH for each HARQ-ACK codebook, is subjected to the capability reported by *twoPUCCH-AnyOthersInSlot.*   (Note: as discussed in Question 2, first bullet can be deleted)   1. We also agree with the clarification suggested by Apple/Huawei above |

## 2.2 A summary of the First Round of Discussions

TBD

# 3 Second Round of Discussions

TBD

## 3.2 A Summary of the Second Round of Discussions

TBD

# 4 References

**[1] R1-2104121, “LS on updated Rel. 16 RAN1 UE feature lists for NR after RAN1#104bis-e,” RAN1**

**[2] R1-2106407, “LS response on two PUCCH capability,” RAN2**