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

**e-Meeting, August 16th – 27th, 2021**

**Source: Moderator (vivo)**

**Title: Summary of [106-e-NR-5G\_V2X-05] Discussion on R1-2107979: Clarification on PUCCH Power control when the number of SL HARQ-ACK bits larger than 11**

**Agenda Item: 7.2.4**

**Document for: Discussion and Decision**

**Introduction**

The document is to collect companies’ inputs and provide a summary for the email discussion thread [106-e-NR-5G\_V2X-05] Discussion on [R1-2107979](file:///C:\Users\Docs\R1-2107979.zip): Clarification on PUCCH Power control when the number of SL HARQ-ACK bits larger than 11 by August 20 – Siqi (vivo)

The 1st point is planned as following, companies are highly appreciated to provide their inputs before this check point:

* **1st check point: August 17, UTC 23:59 pm**

The 2nd check point: [TBD]

**Discussion**

## Issue#1 PUCCH power when there are more than 11 SL HARQ-ACK bits

The transmission power of PUCCH on active UL BWP  of carrier  of primary cell  is determined based on the following formula, where  is a PUCCH transmission power adjustment component which is depended on the PUCCH format as well as the number of UCI bits to be transmitted:

 [dBm]

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| 7.2.1 UE behaviour - For a PUCCH transmission using PUCCH format 2 or PUCCH format 3 or PUCCH format 4 and for a number of UCI bits larger than 11, , where  -  -  -  is a number of HARQ-ACK information bits that the UE determines as described in clause 9.1.2.1 for Type-1 HARQ-ACK codebook and as described in clause 9.1.3.1 or 9.1.3.3 for Type-2 HARQ-ACK codebook, or as described in clause 9.1.4 for Type-3 HARQ-ACK codebook. If the UE is not provided any of *pdsch-HARQ-ACK-Codebook*, *pdsch-HARQ-ACK-Codebook-r16*, or *pdsch-HARQ-ACK-OneShotFeedback*,  if the UE includes a HARQ-ACK information bit in the PUCCH transmission; otherwise,  -  is a number of SR information bits that the UE determines as described in clause 9.2.5.1  -  is a number of CSI information bits that the UE determines as described in clause 9.2.5.2 |

If a PUCCH format2/3/4 is used for SL HARQ-ACK reporting and the number of SL HARQ-ACK bits is larger than 11, **the current spec is not clear on how to determine the  for PUCCH power control as in the current spec the  is defined as the number of HARQ-ACK bits generated for PDSCH** as described in clause 9.1.2.1 for Type-1 HARQ-ACK codebook or as described in clause 9.1.3.1 or 9.1.3.3 for Type-2 HARQ-ACK codebook, or as described in clause 9.1.4 for Type-3 HARQ-ACK codebook. It also seems to imply that SR, CSI should be considered for .

Thus, the UE behavior in the case of reporting more than 11 SL HARQ-ACK bits should be clarified, i.e.,  and  should be set to 0 since multiplexing between SL HARQ-ACK and CSI/SR in a PUCCH is not allowed, and  should be set to the number of the SL HARQ-ACK bits determined in Clause 16.5.1 for type1 codebook or Clause 16.5.2 for type2 codebook.

In [1], following changes are proposed:

***================proposed changes in [1] ===================***

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| 16.5.1.1 Type-1 HARQ-ACK codebook in physical uplink control channel  ====omitted====  If , the UE determines a number of HARQ-ACK information bits for obtaining a transmission power for a PUCCH, as described in clause 7.2.1, as where is a number of HARQ-ACK information bits determined for corresponding PSSCH transmissions with corresponding PSFCH reception occasions in PSFCH reception occasion .  If , and if the PUCCH transmission uses PUCCH format 2 or PUCCH format 3 or PUCCH format 4, the UE determines a transmission power for the PUCCH, as described in Clause 7.2.1, except that  -  =.  - =0  - =0  ====omitted==== |

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| 16.5.2.1 Type-2 HARQ-ACK codebook in physical uplink control channel  ====omitted====  If , the UE determines a number of HARQ-ACK information bits for obtaining a transmission power for a PUCCH, as described in clause 7.2.1, as  where  - is a value of a counter SAI field in a last DCI format 3\_0 scheduling PSSCH transmissions associated with PSFCH reception occasions that the UE detects within the PDCCH monitoring occasions  - if the UE does not detect any DCI format 3\_0 scheduling PSSCH transmissions associated with PSFCH reception occasions in any of the PDCCH monitoring occasions  - is a total number of DCI format 3\_0, scheduling PSSCH transmissions associated with PSFCH reception occasions, that the UE detects within the PDCCH monitoring occasions. if the UE does not detect any DCI format 3\_0 scheduling PSSCH transmissions with associated PSFCH reception occasions in any of the PDCCH monitoring occasions  - is a number of DCI format 3\_0 scheduling PSSCH transmissions with associated PSFCH reception occasions that the UE detects in PDCCH monitoring occasion  - is a number of SL configured grants for which the UE transmits corresponding HARQ-ACK information in a same PUCCH as for HARQ-ACK information corresponding to PSFCH reception occasions within the PDCCH monitoring occasions  If , and if the PUCCH transmission uses PUCCH format 2 or PUCCH format 3 or PUCCH format 4, the UE determines a transmission power for the PUCCH, as described in Clause 7.2.1, except that  -  =.  - =0  - =0  ====omitted==== |

## Company views

Please kindly provide your views in the table below.

**Question 1: Do you agree that issue#1 should be addressed(i.e., power control for PUCCH with more than 11 SL HARQ-ACK bits should be specified)?**

* **If no, please provide the reasons and your suggestions, if any.**

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| --- | --- | --- |
| Company | Agree or not | Comment |
| vivo | agree | For the case with more than 11 SL HARQ-ACK bits, the power control procedure is not defined in the current specification. If this issue is not addressed, it will prevent more than 11 SL HARQ-ACK bits in a PUCCH. |
| Intel | Agree | We admit that > 11 bit case is not captured. This omission should be fixed. |
| NTT DOCOMO | Not agree | The specification part is used not to determine transmit power but to determine the number of HARQ-ACK bits for transmit power determination. The mechanism is needed only in case of O\_ACK < = 11, so the above addition is unnecessary.  Regarding O\_SR(i) and O\_CSI(i), they shall be zero when no multiplexing. This is the existing rule in Uu in our understanding. For example, when HARQ-ACK and SR are multiplexed on a PUCCH, there is no text for O\_CSI(i), which means O\_CSI(i) = 0 automatically.  Note that there is no corresponding text in 9.1.2.1 of 213. |
| Ericsson | Agree | The current specification prevent simultaneous transmission of UCI and SL HARQ-ACK but does not prevent having 12 or more SL HARQ-ACK bits. For the latter case, this power control aspect is not defined in the specification. |
| LG | Not agree | When we make specification description for the SL HARQ-ACK codebook, description for DL HARQ-ACK codebook was a baseline. In my readling of the current spec for the DL HARQ-ACK codebook, this part also does not mention for the case when the number of DL HARQ-ACK bits is larger than 11. In our perspective, there is no reason to have special description for SL HARQ-ACK codebook. For the case when the number of HARQ-ACK bits is lareger than 11 bits, the relevant descritption can be found in section 7.2.1 as follows:  - For a PUCCH transmission using PUCCH format 2 or PUCCH format 3 or PUCCH format 4 and for a number of UCI bits larger than 11, , where  Meanwhile, it seems that we need to modify 7.2.1 section by adding section number of SL HARQ-ACK codebooks. (Please see our answer of Q2). |

**Question 2: Do you agree with the proposed changes for issue#1?**

* **If no, please provide the reasons and your suggestions, if any.**

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| Company | Agree or not | Comment |
| vivo | agree |  |
| Intel | agree |  |
| NTT DOCOMO | Not agree | As commented in Q1. |
| Ericsson | Agree |  |
| LG | Comment | We do not need to have the changes proposed by vivo.  Instaed, we can add power control part directly in 7.2.1 as follows:  - For a PUCCH transmission using PUCCH format 2 or PUCCH format 3 or PUCCH format 4 and for a number of UCI bits smaller than or equal to 11, , where  -  -  is a number of HARQ-ACK information bits that the UE determines as described in Clause 9.1.2.1 for Type-1 DL HARQ-ACK codebook and as described in Clause 9.1.3.1 or 9.1.3.3 for Type-2 DL HARQ-ACK codebook.is the same as  as described in Clause 9.1.4 for Type-3 DL HARQ-ACK codebook. If the UE is not provided any of *pdsch-HARQ-ACK-Codebook*, *pdsch-HARQ-ACK-Codebook-r16*, or *pdsch-HARQ-ACK-OneShotFeedback*,  if the UE includes a DL HARQ-ACK information bit in the PUCCH transmission; otherwise,  -  is a number of HARQ-ACK information bits that the UE determines as described in Clause 16.5.1.1 for Type-1 SL HARQ-ACK codebook and as described in Clause 16.5.2.1 for Type-2 SL HARQ-ACK codebook.  […]  - For a PUCCH transmission using PUCCH format 2 or PUCCH format 3 or PUCCH format 4 and for a number of UCI bits larger than 11, , where  -  -  -  is a number of HARQ-ACK information bits that the UE determines as described in Clause 9.1.2.1 for Type-1 DL HARQ-ACK codebook and as described in Clause 9.1.3.1 or 9.1.3.3 for Type-2 DL HARQ-ACK codebook, or as described in Clause 9.1.4 for Type-3 DL HARQ-ACK codebook. If the UE is not provided any of *pdsch-HARQ-ACK-Codebook*, *pdsch-HARQ-ACK-Codebook-r16*, or *pdsch-HARQ-ACK-OneShotFeedback*,  if the UE includes a DL HARQ-ACK information bit in the PUCCH transmission; otherwise,  -  is a number of HARQ-ACK information bits that the UE determines as described in Clause 16.5.1.1 for Type-1 SL HARQ-ACK codebook and as described in Clause 16.5.2.1 for Type-2 SL HARQ-ACK codebook |

**Summary**

[Based on the discussion, we conclude that ……TBD]

**Reference**

1. R1-2107979, Clarification on PUCCH Power control when the number of SL HARQ-ACK bits larger than 11, vivo