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

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

**Source: Moderator (NTT DOCOMO, INC.)**

Title: Summary of [106-e-NR-5G\_V2X-03]

Agenda Item: 7.2.4

**Document for:** **Discussion and Decision**

# **Introduction**

This document is a summary of the following email discussion.

[106-e-NR-5G\_V2X-03] Discussion on R1-2107837: Correction of SL HARQ-ACK reporting on UL for skipped DG by August 18 - Shohei (DOCOMO)

# **Discussions**

On SL HARQ-ACK report to gNB, [1] claims that there is a case that a UE does not have transmit data on resource(s) corresponding to a SL dynamic grant provided by gNB but the corresponding UE behavior is not defined in the current PHY specifications while MAC layer provides a positive acknowledgment to PHY layer in this situation. gNB does not know the completion of the SL transmission, and will continue to provide unnecessary SL grant(s). The concrete situation is the following:

* Situation A
	+ A SL grant is provided to a UE
	+ The UE does SL transmission(s) on the corresponding resource(s)
	+ The UE receives ACK on the corresponding PSFCH resource
	+ The UE reports the corresponding ACK to the gNB and the HARQ buffer is flushed (see appendix)
	+ The gNB misses the PUCCH
	+ The gNB sends another SL grant for SL retransmission(s)
	+ The UE ignores the SL grant due to no HARQ buffer (see appendix)
	+ MAC layer provides the corresponding positive acknowledgment to PHY layer, but no PHY behavior



Fig. 1: Illustration in [1]

In addition, another situation was raised in the preparation phase as follows. At the same time, one note is commented at the excel sheet, which is that a similar behavior is defined for SL configured grant.

* Situation B
	+ A SL grant is provided to a UE
	+ The UE does SL transmission(s) on the corresponding resource(s)
	+ The UE receives ACK on the corresponding PSFCH resource
	+ The UE does not report ACK to the gNB due to intra-UE prioritization rule, and the HARQ buffer is flushed
	+ The gNB does not receive the PUCCH
	+ The gNB sends another SL grant for SL retransmission(s)
	+ The UE ignores the SL grant due to no HARQ buffer (see appendix)
	+ MAC layer provides the corresponding positive acknowledgment to PHY layer, but no PHY behavior

Then moderator asks the following questions to companies.

**Q1: Do you agree that the above situations are valid in the current specifications?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment (if any) |
| OPPO | Yes |  |
| Intel | Yes |  |
| vivo | Yes |  |
| NEC | Yes  |  |
| Huawei, HiSilicon | Yes |  |
| Apple | Yes |  |
| Qualcomm | Yes |  |
| Ericsson | Yes |  |
| Nokia, NSB | Yes |  |
| LG | Yes |  |
| Samsung | Yes |  |
| Fujitsu | Yes |  |
| CATT, GOHIGH | Yes |  |
| NTT DOCOMO | Yes |  |
| Moderator |  | All companies agreed the above situations are valid in the current specifications. |

**Q2: Do you agree that a correction for the situations is necessary?**

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| --- | --- | --- |
| Company | Yes/No | Comment (if any) |
| OPPO | Yes. |  |
| Intel | Yes |  |
| vivo | Yes |  |
| NEC | Yes  |  |
| Huawei, HiSilicon | Yes |  |
| Apple | Yes |  |
| Qualcomm | Yes |  |
| Ericsson | Yes |  |
| Nokia, NSB | Yes |  |
| LG |  | It seems that this correction is for optimization rather than essential correction. In case of situation A, the same situation will happen for the DL HARQ-ACK feedback (that is well known as NACK-ACK error), but in my understanding, there is not special handling for this. Instead, NACK-to-ACK error has more tightened requirement. In case of situation B, this situation is newly introduced due to SL. Even if the change is not adopted, the system is still working with some inefficiency. We are fine with the change if the majority companies are really wanted, but further optimization is not welcome for the maintenance phase. [Moderator]: Thank you for comment. For situation A, this situation is different from NACK-to-ACK error for DL data. Rather, this error is a kind of ACK-to-NACK. And the key issue is that in this situation, gNB would transmit SL grant many times and no feedback is reported for any of the SL grants. For situation B, the key issue is the same as situation A. And in both situations, the inefficiency is not small as abovementioned (i.e. ignoring many SL grants by UE). Therefore companies think this correction is essential rather than optimization, in my understanding. |
| Samsung | Yes |  |
| Fujitsu | Yes |  |
| CATT, GOHIGH | Yes |  |
| NTT DOCOMO | Yes |  |
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**Q3: Do you agree the following correction? If modification is needed, please comment in detail.**

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| --- |
| **<Unchanged parts omitted>**16.5 UE procedure for reporting HARQ-ACK on uplink**<Unchanged parts omitted>**The UE generates an ACK if the UE does not transmit a PSCCH with a SCI format 1-A scheduling a PSSCH in any of the resources provided by a dynamic grant or a configured grant in a single period and for which the UE is provided a PUCCH resource to report HARQ-ACK information. The priority value of the ACK is same as the largest priority value among the possible priority values for the dynamic grant or the configured grant.**<Unchanged parts omitted>** |

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| --- | --- | --- |
| Company | Yes/No | Comment (if any) |
| OPPO | Yes.  |  |
| Intel | Yes |  |
| vivo | Yes |  |
| NEC | Yes  |  |
| Huawei,HiSilicon | Need clarification | We are wondering whether the paragraph will mislead with the case that PSSCH is not transmitted due to prioritization, because in this paragraph it does not refer to the reason why PSSCH is not transmitted. Maybe we can say “as instructed by high layer” to remove the ambiguity. On other hand, it seems more simply to say “a grant” rather than “a dynamic grant or a configured grant” to provide the resource. So we suggest to have further modifications below: *The UE generates an ACK as instructed by high layer if the UE does not transmit a PSCCH with a SCI format 1-A scheduling a PSSCH in any of the resources provided by a ~~dynamic grant or a configured~~ grant in a single period and for which the UE is provided a PUCCH resource to report HARQ-ACK information. The priority value of the ACK is same as the largest priority value among the possible priority values for the ~~dynamic grant or the configured~~ grant.*[Moderator]: Thank you for comment. Regarding the case that PSSCH is not transmitted due to prioritization, this case is not included in this discussion and the case is described the paragraphs right before this paragraph.If the comment intends situation B, i.e. the case that PUCCH is not transmitted due to prioritization, this situation is covered since now we are talking UE behavior after receiving SL grant but no transmit data. The reason of no transmit data can be either PUCCH missing or PUCCH drop due to prioritization. But we are OK with either way. Let us ask companies whether needed or not.For the comment of “a grant”, 38.213 does not use this terminology (16.5.2.1 uses but as “the SL configured grant provides a grant for ...”. Only “a grant” is not used.). Just “a grant” would lead to misunderstanding, so clear text is better. |
| Apple | Yes |  |
| Qualcomm |  | We’re ok with the proposed text or the one from Huawei |
| Ericsson | Yes |  |
| Nokia, NSB | Yes | A minor comment is that the rest of this section does not use the “dynamic grant” terminology.[Moderator]: Thank you for comment. Exactly section 16.5 does not use “dynamic grant”, but section 16.4 of 213 is using “provided by a dynamic grant or by a SL configured grant”. I cannot see any issue to use this terminology here. |
| Samsung | Yes |  |
| Fujitsu | Yes |  |
| CATT, GOHIGH | Yes |  |
| NTT DOCOMO | Yes |  |
|  |  |  |

# **Conclusion**

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# **References**

1. R1-2107837 NTT DOCOMO, INC.

# **Appendix**

The current MAC specifications related to this discussions:

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| 5.22.1.3.1 Sidelink HARQ Entity...For each sidelink grant, the Sidelink HARQ Entity shall:...1> else (i.e. retransmission):2> if the HARQ Process ID corresponding to the sidelink grant received on PDCCH, the configured sidelink grant or the selected sidelink grant is associated to a Sidelink process of which HARQ buffer is empty; or2> if the HARQ Process ID corresponding to the sidelink grant received on PDCCH is not associated to any Sidelink process:3> ignore the sidelink grant....5.22.1.3.1a Sidelink process...To generate a transmission, the Sidelink process shall:...1> if a positive acknowledgement to this transmission of the MAC PDU was received according to clause 5.22.1.3.2; or1> if negative-only acknowledgement was enabled in the SCI and no negative acknowledgement was received for this transmission of the MAC PDU according to clause 5.22.1.3.2:2> flush the HARQ buffer of the associated Sidelink process....5.22.1.3.2 PSFCH reception...If *sl-PUCCH-Config* is configured by RRC, the MAC entity shall for a PUCCH transmission occasion:1> if the *timeAlignmentTimer*, associated with the TAG containing the Serving Cell on which the HARQ feedback is to be transmitted, is stopped or expired:...1> else if a MAC PDU has been obtained for a sidelink grant associated to the PUCCH transmission occasion in clause 5.22.1.3.1, the MAC entity shall:...1> else:2> instruct the physical layer to signal a positive acknowledgement on the PUCCH according to clause 16.5 of TS 38.213 [6]. |

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| 5.22.1.4.1.3 Allocation of sidelink resources...The MAC entity shall not generate a MAC PDU for the HARQ entity if the following conditions are satisfied:- there is no Sidelink CSI Reporting MAC CE generated for this PSSCH transmission as specified in clause 5.22.1.7; and- the MAC PDU includes zero MAC SDUs.... |