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

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

**Agenda Item: 7.2.5**

**Source: Moderator (Huawei, HiSilicon)**

**Title: Summary of [106-e-NR-L1enh-URLLC-08] Issue#12: Correction for PUSCH repetition Type B in 38.213 (38.214)**

**Document for: Discussion and Decision**

# Introduction

Following email thread is dedicated to discuss the issue in R1-2108199 [1] and R1-2106512 [2].

**Background of Changes:**

For collision handling between a low priority PUSCH transmission and a high priority PUCCH transmission, when the PUSCH transmission is configured with PUSCH repetition type B, it is not clear whether an actual repetition or a nominal repetition should be cancelled.

According to the agreements from RAN1 #98b, UL CI is applied already to each actual repetition (rather than all nominal repetitions) in case of PUSCH repetition type B.

**Proposed Changes:**

**Text Proposal 1 (for 38.213)**

To have a unified UE behaviour of PUSCH cancellation, the same principal as for UL CI should be used for the collision between UL transmissions with different priorities, where the question whether it is for nominal or actual repetitions still is open in the current spec. Hence, it should be clarified that the overlapping actual repetition should be cancelled when the collision between a low priority PUSCH transmission and a high priority PUCCH transmission happens.

**Text Proposal 1:**

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| 9 UE procedure for reporting control information< Unchanged parts are omitted >When a UE determines overlapping for PUCCH transmissions with SL HARQ-ACK reports and PUCCH of larger and/or smaller priority index, the UE resolves the overlapping for PUCCH transmissions with SL HARQ-ACK reports and PUCCH of each priority index as described in clause 9.2.5 and 9.2.6 before resolving the overlapping for PUCCH transmissions without SL HARQ-ACK or the overlapping for PUCCH transmissions and PUSCH transmissions.When a UE determines overlapping for PUCCH and/or PUSCH transmissions of different priority indexes other than PUCCH transmissions with SL HARQ-ACK reports before considering limitations for UE transmission as described in clause 11.1, including repetitions if any, the UE first resolves the overlapping for PUCCH and/or PUSCH transmissions of smaller priority index as described in clauses 9.2.5 and 9.2.6. Then, - if a transmission of a first PUCCH of larger priority index scheduled by a DCI format in a PDCCH reception would overlap in time with a (actual) repetition of a transmission of a second PUSCH or a second PUCCH of smaller priority index, the UE cancels the repetition of a (actual) transmission of the second PUSCH or the second PUCCH before the first symbol that would overlap with the first PUCCH transmission- if a transmission of a first PUSCH of larger priority index scheduled by a DCI format in a PDCCH reception would overlap in time with a repetition of the transmission of a second PUCCH of smaller priority index, the UE cancels the repetition of the transmission of the second PUCCH before the first symbol that would overlap with the first PUSCH transmissionwhere - the overlapping is applicable before or after resolving overlapping among channels of larger priority index, if any, as described in clauses 9.2.5 and 9.2.6- any remaining PUCCH and/or PUSCH transmission after overlapping resolution is subjected to the limitations for UE transmission as described in clause 11.1- the UE expects that the transmission of the first PUCCH or the first PUSCH, respectively, would not start before $T\_{proc,2}$ after a last symbol of the corresponding PDCCH reception- $T\_{proc,2} $is the PUSCH preparation time for a corresponding UE processing capability assuming $d\_{2,1}= d\_{1}$ [6, TS 38.214], based on $μ$ and $N\_{2}$ as subsequently defined in this clause, and $d\_{1}$ is determined by a reported UE capabilityIf a UE is scheduled by a DCI format in a first PDCCH reception to transmit a first PUCCH or a first PUSCH of larger priority index that overlaps with a second PUCCH or a second PUSCH transmission of smaller priority index that, if any, is scheduled by a DCI format in a second PDCCH- $T\_{proc,2}$ is based on a value of $μ$ corresponding to the smallest SCS configuration of the first PDCCH, the second PDCCHs, the first PUCCH or the first PUSCH, and the second PUCCHs or the second PUSCHs - if the overlapping group includes the first PUCCH- if *processingType2Enabled* of *PDSCH-ServingCellConfig* is set to *enable* for the serving cell where the UE receives the first PDCCH and for all serving cells where the UE receives the PDSCHs corresponding to the second PUCCHs, and if *processingType2Enabled* of *PUSCH-ServingCellConfig* is set to *enable* for the serving cells with the second PUSCHs, $N\_{2} $is 5 for $μ=0$, 5.5 for $μ=1$ and 11 for $μ=2$ - else, $N\_{2} $is 10 for $μ$=0*,* 12 for $μ=1$, 23 for $μ=2$, and 36 for $μ=3$;- if the overlapping group includes the first PUSCH - if *processingType2Enabled* of *PUSCH-ServingCellConfig* is set to *enable* for the serving cells with the first PUSCH and the second PUSCHs and if *processingType2Enabled* of *PDSCH-ServingCellConfig* is set to *enable* for all serving cells where the UE receives the PDSCHs corresponding to the second PUCCHs, $N\_{2} $is 5 for $μ=0$, 5.5 for $μ=1$ and 11 for $μ=2$- else, $N\_{2} $is 10 for $μ$=0*,* 12 for $μ=1$, 23 for $μ=2$, and 36 for $μ=3$;If a UE would transmit the following channels, including repetitions if any, that would overlap in time- a first PUCCH of larger priority index with SR and a second PUCCH or PUSCH of smaller priority index, or - a configured grant PUSCH of larger priority index and a PUCCH of smaller priority index, or- a first PUCCH of larger priority index with HARQ-ACK information only in response to a PDSCH reception without a corresponding PDCCH and a second PUCCH of smaller priority index with SR and/or CSI, or a configured grant PUSCH with smaller priority index, or a PUSCH of smaller priority index with SP-CSI report(s) without a corresponding PDCCH, or - a PUSCH of larger priority index with SP-CSI reports(s) without a corresponding PDCCH and a PUCCH of smaller priority index with SR, or CSI, or HARQ-ACK information only in response to a PDSCH reception without a corresponding PDCCH, or- a configured grant PUSCH of larger priority index and a configured PUSCH of lower priority index on a same serving cellthe UE is expected to cancel a (actual) repetition of the PUCCH/PUSCH transmissions of smaller priority index before the first symbol overlapping with the PUCCH/PUSCH transmission of larger priority index if the (actual) repetition of the PUCCH/PUSCH transmissions of smaller priority index overlaps in time with the PUCCH/PUSCH transmissions of larger priority index.< Unchanged parts are omitted > |

**Text Proposal 2 (for 38.214)**

For the third termination condition for configured UL transmission, it is not clear whether it is related to an actual repetition or to a nominal repetition.

The underlying principle for the termination condition is that the DG PUSCH transmission can override CG PUSCH transmission, which results in the cancellation of CG PUSCH transmission.

According to the agreements from RAN1 #98b, UL CI is applied already to each actual repetition (rather than all nominal repetitions) in case of PUSCH repetition type B. To have a unified UE behaviour of PUSCH cancellation, the same principal should be used for the third termination condition for configured UL transmission, where the question whether it is for nominal or actual repetitions still is open in the current spec. Hence, it should be clarified that the actual repetition is cancelled.

**Text proposal 2:**

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| 6.1.2.3.2 Transport Block repetition for uplink transmissions of PUSCH repetition Type B with a configured grantThe procedures described in this Clause apply to PUSCH transmissions of PUSCH repetition type B with a Type 1 or Type 2 configured grant.For PUSCH transmissions with a Type 1 or Type 2 configured grant, the nominal repetitions and the actual repetitions are determined according to the procedures for PUSCH repetition Type B defined in Clause 6.1.2.1. The higher layer configured parameters *repK-RV* defines the redundancy version pattern to be applied to the repetitions. If the parameter *repK-RV* is not provided in the *configuredGrantConfig*, the redundancy version for each actual repetition with a configured grant shall be set to 0. Otherwise, for the *n*th transmission occasion among all the actual repetitions (including the actual repetitions that are omitted) of the *K* nominal repetitions, it is associated with *(mod(n-1,4)+1)th* value in the configured RV sequence. If a configured grant configuration is configured with *startingFromRV0* set to 'off', the initial transmission of a transport block may only start at the first transmission occasion of the actual repetitions. Otherwise, the initial transmission of a transport block may start at - the first transmission occasion of the actual repetitions if the configured RV sequence is {0,2,3,1},- any of the transmission occasions of the actual repetitions that are associated with RV=0 if the configured RV sequence is {0,3,0,3},- any of the transmission occasions of the actual repetitions if the configured RV sequence is {0,0,0,0}, except the actual repetitions within the last nominal repetition when *K≥8*. For any RV sequence, the repetitions shall be terminated after transmitting K nominal repetitions, or at the last transmission occasion among the *K* nominal repetitions within the period *P*, or from the starting symbol of an actual repetition that overlaps with a PUSCH with the same HARQ process scheduled by DCI format 0\_0, 0\_1 or 0\_2, whichever is reached first. The UE is not expected to be configured with the time duration for the transmission of *K* nominal repetitions larger than the time duration derived by the periodicity *P*.< Unchanged parts are omitted > |

# Company views

**Text proposal for 38.213**

**Q1:** Do you agree with the analysis of background of changes and support the corresponding Text proposal 1 for 38.213?

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| Company | Comments |
| Nokia, NSB | **Do not agree**. We do not see that this TP / CR would be needed. In 38.214, we specify the structure of a PUSCH rep. Type B transmission and from there it should be clear that for PUSCH rep. Type B the PUSCH repetition transmission is based on actual PUSCH repetitions already. In 38.213, we only take the final ‘PUSCH structure’ (i.e. t-domain resource allocation defined in 38.214) of a PUSCH / PUSCH repetition into account in the prioritization procedure. Therefore, we don’t think that this would be needed. Moderator: In Nokia’s understanding, all repetition in 213 are actual transmissions and therefore no clarification is needed. However, in my view, there are also nominal transmissions treated in 213. For example for Uplink power control, section 7:“*A PUSCH/PUCCH/SRS/PRACH transmission occasion* $i$ *is defined by a slot index* $n\_{s,f}^{μ}$ *within a frame with system frame number* $SFN$*, a first symbol* $S$ *within the slot, and a number of consecutive symbols* $L$*. For a PUSCH transmission with repetition Type B, a PUSCH transmission occasion is a nominal repetition [6, TS 38.214].”*Therefore, there is still an ambiguity in the 213 regarding nominal/actual transmissions and it should be clarified for the cancellation due to different priorities. |
| ZTE | Support the intention, while we also agree with Nokia that there should be no ambiguity as whether a repetition will be transmitted should be based on actual repetition. With said above, it could be better to leave to editors for non-essential correction if needed.  |
| CATT | We do not have a strong view on whether specification change is needed. We would be fine to follow majority view. |
| OPPO | We fully understand the intention of the CR, and we share similar view with Nokia that there is no ambiguity for a PUSCH repetition transmission. We are ok whether to adopt the changes or not. |

**Text proposal for 38.214**

**Q2:** Do you agree with the analysis of background of changes and support the corresponding Text proposal 2 for 38.214?

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| Company | Comments |
| Nokia, NSB | **Agree**. But as this is a very minor change (no real operational change), maybe this **could be put in the alignment CR directly** (as for issues in email thread #13) |
| ZTE | Agree with Nokia. Note that, there is an ongoing discussion about scheduling and canceling of PUSCH with the same HARQ process in [106-e-NR-7.1CRs-01]. It may or may not clarify/update the same sentence to be revised here. However, as commented above, whether a repetition will be transmitted should be based on actual repetition. Therefore, we think there should be no conflict between the two discussions.  |
| CATT | We prefer to discuss the TP after [106-e-NR-7.1CRs-01] is concluded. |
| OPPO | Agree. |

# Outcome

TBD.

# References

[1]: R1-2108199 “Correction for PUSCH repetition Type B in 38.213”, Huawei, HiSilicon, 3GPP TSG-RAN WG1 Meeting #106-e , E-meeting, Aug 16th-27th, 2021

[2]; R1-2106512 “Correction for PUSCH repetition Type B in 38.214”, Huawei, HiSilicon, 3GPP TSG-RAN WG1 Meeting #106-e , E-meeting, Aug 16th-27th, 2021