**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

[106-e-NR-L1enh-URLLC-08] Issue#12: Correction for PUSCH repetition Type B in 38.213 (38.214) by August 20 – Thorsten (Huawei)

Please provide the first round of comments by **August 18, 05:00 UTC**

# Presentation of background and proposals

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)**

In [1] a TP is given 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 transmission  where  - 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 after a last symbol of the corresponding PDCCH reception  - is the PUSCH preparation time for a corresponding UE processing capability assuming [6, TS 38.214], based on and as subsequently defined in this clause, and is determined by a reported UE capability  If 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  - is based on a value of 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, is 5 for , 5.5 for  and 11 for  - else, is 10 for =0*,* 12 for , 23 for , and 36 for ;  - 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, is 5 for , 5.5 for  and 11 for  - else, is 10 for =0*,* 12 for , 23 for , and 36 for ;  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 cell  the 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)**

In [2] a TP is given 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 grant  The 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 > |

# Discussion and company views

## First round of discussions

**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?

|  |  |
| --- | --- |
| 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 is defined by a slot index within a frame with system frame number , a first symbol within the slot, and a number of consecutive symbols . 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. |
| HW/HiSi | We support the TP |
| Ericsson | The TP is not needed.  We agree with Nokia that it is clear that for PUSCH repetition type B, the cancellation in 38.213 section 9 is applied to an actual repetition. In 38.214 section 6.1.2.1, the sentence below has clarified already:  “*An actual repetition is omitted according to the conditions in Clause 9, Clause 11.1 and Clause 11.2A of [6, TS38.213].*” |
| Qualcomm | We agree with Nokia and others that the behavior is already clear in the specification. |
| Intel | Agree with Nokia and others that for Type B PUSCH repetitions, the current specs are already clear that actual repetitions are used. Thus, spec updates are not needed. |

**Moderator update 1**

Nokia commented in their answer to Q1:

“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”.

From the moderator perspective, if the statement above from Nokia would be valid, then throughout the specification of 213, no nominal repetitions should be mentioned. But for example for UL power control, nominal repetitions are described in 38.213. It would be great to hear more views from other companies, if this is a contradiction that needs to be clarified.

For reference, the corresponding text from 38.213 is copied below.

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| 7 Uplink power control:  A PUSCH/PUCCH/SRS/PRACH transmission occasion is defined by a slot index within a frame with system frame number , a first symbol within the slot, and a number of consecutive symbols . For a PUSCH transmission with repetition Type B, a PUSCH transmission occasion is a nominal repetition [6, TS 38.214]. |

**Question 1a:** Taking the above comments into account, companies are encouraged to share their view whether it is clear that PUSCH repetition type B in 38.213 always means an actual repetition or if there still room for ambiguity and should be clarified?

|  |  |
| --- | --- |
| Company | Comments |
| Ericsson | It is true that PUSCH repetition is not always a nominal repetition, as the sentence in section 7 shows.  On the other hand, in our understanding, what a ‘repetition’ refers to has been clear in various contexts. For example, the sentence in section 7 above; the sentence in 38.214 section 6.1.2.1 (see our response earlier). |
| Intel | The example from UL power control is actually an exception and hence, “nominal” has to be spelled out (and thus, has been). There should not be an ambiguity from reading of the rest of the specs (as pointed out by Ericsson in response to Question #1) that all other dropping/cancelation considerations are based on actual repetitions. |

**End Moderator update 1**

**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.  Moderator: We can check the progress in that discussion after its first deadline. |
| OPPO | Agree. |
| HW/HiSi | Agree with the TP and we think it is more than an editorial and should be discussed in this thread. |
| Ericsson | Agree with the TP.  We also think this is such a small change that it can be taken care of via the alignment CR. |
| Qualcomm | Agree. As others pointed out, the change can be made in the alignment CR. |
| Intel | Agree and also agree with Nokia and others that the 214 update can be considered as part of alignment CR. |

## Second round of discussions

**Please provide you feedback not later than Aug 19, UTC 14:00 UTC**

**Round 2 discussion for 38.213**

8 companies provided feedback

* (4): No change needed:
  + Nokia/NSB, Ericsson, Qualcomm, Intel
* (1) Support the intention, but should already be clear and can be left to the editor:
  + ZTE
* (2) Neutral
  + CATT, Oppo
* (1) Support the TP for 38.213
  + HW/HiSi

However, the technical arguments that have been provided by opponents of the CR deserve some further analysis. I comment the feedback from Nokia, Intel and Ericsson below.

**Table 1 – Clarifications on actual/nominal repetitions**

|  |  |  |
| --- | --- | --- |
| Company | Comment from Round 1 | Moderator feedback |
| Nokia | 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 | This statement does not appear to be correct in my understanding. Not all repetitions in 213 are actual repetitions. For example in 38.213 nominal repetitions are used:  *7 Uplink power control:*  *A PUSCH/PUCCH/SRS/PRACH transmission occasion is defined by a slot index within a frame with system frame number , a first symbol within the slot, and a number of consecutive symbols . For a PUSCH transmission with repetition Type B, a PUSCH transmission occasion is a nominal repetition [6, TS 38.214].* |
| Intel | The example from UL power control is actually an exception and hence, “nominal” has to be spelled out (and thus, has been). There should not be an ambiguity from reading of the rest of the specs | I have checked the whole spec and it is always said explicitly “actual repetition” or “nominal repetition”. Only for the case we are discussing here it is left out. In my view, it has to be clarified to avoid ambiguity. |
| Ericsson | We agree with Nokia that it is clear that for PUSCH repetition type B, the cancellation in 38.213 section 9 is applied to an actual repetition. In 38.214 section 6.1.2.1, the sentence below has clarified already:  “*An actual repetition is omitted according to the conditions in Clause 9, Clause 11.1 and Clause 11.2A of [6, TS38.213].*”*Clause 11.1 and Clause 11.2A of [6, TS38.213].*” | In my understanding the reference here does not imply that repetition in clause 9 of 38.213 always has to be an actual repetition. In fact, it shows that a clarification is needed.  In clause 11.2A, for example, it is explicitly talked about an “actual repetition”. But in clause 9, only repetition is mentioned.  From 11.2A:  *A UE that detects a DCI format 2\_4 for a serving cell cancels a PUSCH transmission or an actual repetition of a PUSCH transmission [6, TS 38.214] if the PUSCH transmission is with repetition Type B,* |

**According to my understanding, the provided reasons why no change is needed do not seem to be really valid but instead they are showing the opposite, i.e. that a clarification is needed to avoid ambiguity.**

Based on the clarifications given in Table 1 above I would like to respectfully ask if companies can change their initial opinion and support the TP.

**Q1b:** Based on the clarifications given in Table 1, the necessity of the Text Proposal 1 for 38.213 is now clarified. Do you still have strong concerns? If yes, please explain the reason.

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| --- | --- |
| Company | Comments |
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**Round 2 discussion for 38.214**

8 companies provided feedback. 7 companies agree on the correction but have different views whether it is an alignment CR or not. 1 company did not say if they agree or not, but want to wait for the outcome of a Rel-15 discussion.

* (5): Agree but can be put into alignment CR
  + Nokia/NSB, ZTE, Ericsson, Qualcomm, Intel
* (2) Agree with the TP
  + Oppo, HW/HiSi
* (1) Discuss after [106-e-NR-7.1CRs-01] is concluded.

According to the feedback from CATT we may still wait for the outcome for the Rel-15 discussion to see whether any new changes need be included. As background information, in Rel-15 [106-e-NR-7.1CRs-01], the same paragraph as here is discussed, but the contents of the discussions is different. Also right now, it is uncertain if and when there would be any change to Rel-15.

For an efficient handling of the proposal, it is suggested to handle it in this thread and to not move it to alignment CR.

Therefore, to clarify for 38.214, section 6.1.2.3.2 that the third termination condition for configured UL transmission is related to actual repetitions, it is proposed to agree on the current wording of the Text Proposal 2 for 38.214, and to add a note that the exact wording may be subject to change if this is later required due to the outcome of the Rel-15 discussion [106-e-NR-7.1CRs-01]. I hope that this addresses the comment from CATT.

***Proposal:*** *The following text proposal is endorsed.*

* *Note: the exact wording of the TP could change later depending in the outcome of the discussion [106-e-NR-7.1CRs-01],*

Text Proposal for 38.214:

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| --- |
| 6.1.2.3.2 Transport Block repetition for uplink transmissions of PUSCH repetition Type B with a configured grant  The 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 > |

Companies please indicate if you have a strong concern with the proposal for 38.214:

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| Company | Comments |
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# 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