**3GPP TSG RAN WG1 #114** **R1-230xxxx**

**Toulouse, France, August 21st – 25th, 2023**

**Agenda item:** 9.17

**Source:** Samsung

**Title:** Summary of email discussions [114-R18-38.213-NR\_XR\_enh]

**Document for:** Discussion and decision

# Introduction

The purpose of this document is to collect inputs/comments on the draft CR for TS 38.213 [draftCR\_38213 XR](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_114/Inbox/drafts/9.17%28Other%29/%5B38.213%20draft%20CRs%5D/NR_XR_enh/R1-230xxxx%20draftCR_38213%20XR.docx) on the introduction of XR Enhancements for NR. If a comment on a particular aspect has been made by another company, please do not repeat it until, if needed, after a response.

The first checkpoint is on September 5, UTC 13:00.

# First Round Discussion

Please provide your comments on the draft CR for TS 38.213 [draftCR\_38213 XR](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_114/Inbox/drafts/9.17%28Other%29/%5B38.213%20draft%20CRs%5D/NR_XR_enh/R1-230xxxx%20draftCR_38213%20XR.docx).

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| Company | Comments |
| Qualcomm | Comment 1: According to the following RAN1 #92bis agreement, we are not sure whether it is correct or necessary to state that “The CG-UCI has same priority value as the PUSCH”.Agreement:CG-UCI is mapped as per Rel-15 rules with CG-UCI having the highest priority (CG-UCI is mapped on the symbols starting after first DMRS symbol)

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| For a PUSCH transmission that is configured by a *ConfiguredGrantConfig* and includes CG-UCI, the UE multiplexes the CG-UCI in the PUSCH transmission using a $I\_{offset}^{CG-UCI}$ value provided by *betaOffsetCG-UCI* with the mapping defined in Table 9.3-1. The CG-UCI has same priority value as the PUSCH. If the UE is provided *cg-UCI-Multiplexing* and multiplexes HARQ-ACK information of same priority value as the CG-UCI in the PUSCH transmission, as described in clauses 9 and 9.2.5, the UE jointly encodes the HARQ-ACK information and the CG-UCI [5, TS 38.212] and determines a number of resources for multiplexing the combined information in a PUSCH using $β\_{offset}^{HARQ-ACK}$ which provides indexes $I\_{offset,1}^{HARQ-ACK}$ and $I\_{offset,2}^{HARQ-ACK}$ for the UE to use if the UE multiplexes up to 11, and more than 11 combined information bits, respectively.  |

Comment 2: The following CR seems to imply the UTO-UCI is only applicable to multi-PUSCH CG period. This is still under discussion without a conclusion yet. Suggest to remove the first sentence “A UE can be indicated, by *nrofSlots\_InCGperiod* in *configuredGrantConfig*, more than one TO for CG-PUSCH transmission within a period of a CG-PUSCH configuration [6, TS 38.214].”

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| 9.3.1 UE procedure for reporting UTO-UCIA UE can be indicated, by *nrofSlots\_InCGperiod* in *configuredGrantConfig*, more than one TO for CG-PUSCH transmission within a period of a CG-PUSCH configuration [6, TS 38.214]. If the UE is also provided *nrof\_UTO\_UCI* with value equal to $N\_{TO}$, the UE multiplexes UTO-UCI represented by a bitmap of $N\_{TO}$ bits in each CG-PUSCH transmission for the CG-PUSCH configuration.  |

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| Ericsson | Thanks Editor for the great efforts to provide the draft CR. We have some comments similarly as QC with some suggestions for your consideration.**Comment 1:** Regarding the new condition of same priority for multiplexing HARQ-ACK and CG-UCI or UTO-UCI, we don’t think it is needed.In addition to the cited agreement from QC, in Rel-17 when UCI multiplexing of different priorities were introduced, the following agreement was made for CH-UCI:**Agreement (RAN1#106bis-e)*** When performing Intra-UE multiplexing procedure, if a PUCCH withHARQ-ACK overlaps with a CG-PUSCH and the cg-RetransmissionTimer is configured:
	+ If the HARQ-ACK and the CG-PUSCH have the same priority and the CG-PUSCH is selected for HARQ-ACK multiplexing:
		- * If cg-UCI-Multiplexing is enabled for that CG-PUSCH, HARQ-ACK would be multiplexed in CG-PUSCH.
			* Otherwise, CG-PUSCH would be dropped.
	+ If the HARQ-ACK and the CG-PUSCH have different priority and the CG-PUSCH is selected for HARQ-ACK multiplexing:
		- If multiplexing HARQ-ACK on the CG-PUSCH with different priority is not indicated,
			* The LP channel between PUCCH or CG-PUSCH would be dropped as in Rel-16.
		- If multiplexing HARQ-ACK on the CG-PUSCH with different priority is indicated,
			* + If cg-UCI-Multiplexing is enabled for that CG-PUSCH, HARQ-ACK would be multiplexed in CG-PUSCH.
				+ Otherwise, the LP channel would be dropped.

Hence, basically, HARQ-ACK with different priority than CG-UCI can be multiplexed in CG-PUSCH and the beta offset, would be the one of HARQ-ACK.For UTO-UCI we apply the same , assuming UTO-UCI and HARQ-ACK joint coding is always enabled (since we did not agree to introduce an RRC like cg-UCI-Multiplexing to disable the joint coding).**Comment 2**: Similarly to QC, UTO-UCI indication is a separate feature for CG PUSCH, including legacy and multi-PUSCH Rel-18. Perhaps the following modification can be considered:9.3.1       UE procedure for reporting UTO-UCI~~A UE can be indicated, by~~ *~~nrofSlots\_InCGperiod~~* ~~in~~ *~~configuredGrantConfig~~*~~, more than one TO for CG-PUSCH transmission within a period of a CG-PUSCH configuration [6, TS 38.214].~~ If the UE is ~~also~~ provided *nrof\_UTO\_UCI* with value equal to$N\_{TO}$ in *configuredGrantConfig* of a CG-PUSCH configuration [6, TS 38.214],  the UE multiplexes UTO-UCI represented by a bitmap of$N\_{TO}$ bits in each CG-PUSCH transmission for the CG-PUSCH configuration. **Comment 3: For** completeness it is good to define the order of mapping , e.g. the MSB of bit map corresponds to the next TO and the LSB bit to the last TO in the following text in 9.3.1.The UTO-UCI of $N\_{TO}$ bits has a one-to-one mapping to $N\_{TO}$ subsequent CG-PUSCH TOs. |
| DOCOMO | Regarding comment 1 from QC and Ericsson, we have different view.We agree with the editor’s update on “The CG-UCI has same priority value as the PUSCH” in principle. Regarding the agreement cited by QC, our understanding is that the intention of the agreement is not about physical priority. The “priority” in the agreement is for RE mapping based on Rel-15 rules. Note that there is no “physical priority” in Rel-15.For Ericsson’s cited agreements, we also have different understanding. Our understanding on the cited agreements is that it only talks about whether/how to multiplex UCI on CG PUSCH. However, whether separate encoding or joint encoding for HARQ-ACK and CG-UCI is not touched. Based on following texts in TS 38.212 section 6.3.2.4.2.6, our understanding is:* CG-UCI priority value is same as CG PUSCH
* HARQ-ACK and CG-UCI with different priority values are separately encoded (which seems different from Ericsson’s understanding)

To summarize, we think the current CR for this issue is fine.

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| 6.3.2.4.2.6 UCI with different priority indexes<\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*>If *uci-MuxWithDiffPrio* is configured, and HARQ-ACK bits associated with priority index 0, HARQ-ACK bits associated with priority index 1 and/or CG-UCI associated with priority index 1, and CSI part 1 if any are transmitted on a PUSCH: - Perform rate matching for HARQ-ACK with priority index 1 according to clause 6.3.2.4.2.1, by taking HARQ-ACK with priority index 1 as HARQ-ACK and replacing $β\_{offset}^{PUSCH}$ by $β\_{offset}^{HARQ-ACK-HP}$, if HARQ-ACK bits associated with priority index 1 are transmitted without CG-UCI associated with priority index 1.- Perform rate matching for CG-UCI with priority index 1 according to clause 6.3.2.4.2.4, if CG-UCI associated with priority index 1 is transmitted without HARQ-ACK bits associated with priority index 1.- Perform rate matching for CG-UCI with priority index 1 and HARQ-ACK with priority index 1 according to clause 6.3.2.4.2.5, if both CG-UCI associated with priority index 1 and HARQ-ACK bits associated with priority index 1 are transmitted, by taking HARQ-ACK with priority index 1 as HARQ-ACK and replacing $β\_{offset}^{PUSCH}$ by $β\_{offset}^{HARQ-ACK-HP}$.- If CSI part 1 is also transmitted on the PUSCH and the PUSCH is associated with priority index 1,- Perform rate matching for CSI part 1 according to clause 6.3.2.4.2.2, by taking HARQ-ACK with priority index 1 if any as HARQ-ACK, and taking CG-UCI associated with priority index 1 if any as CG-UCI.- Perform rate matching for HARQ-ACK with priority index 0 according to clause 6.3.2.4.2.3, by taking HARQ-ACK with priority index 0 as CSI part 2 and replacing $β\_{offset}^{PUSCH}$ by $β\_{offset}^{HARQ-ACK-LP}$, and taking HARQ-ACK with priority index 1 if any as HARQ-ACK, and taking CG-UCI associated with priority index 1 if any as CG-UCI.- Otherwise,- Perform rate matching for HARQ-ACK with priority index 0 according to clause 6.3.2.4.2.2, by taking HARQ-ACK with priority index 0 as CSI-part 1 and replacing $β\_{offset}^{PUSCH}$ by $β\_{offset}^{HARQ-ACK-LP},$ and taking HARQ-ACK with priority index 1 if any as HARQ-ACK, and taking CG-UCI associated with priority index 1 if any as CG-UCI.- Perform rate matching for CSI part 1 according to clause 6.3.2.4.2.3, by taking CSI part 1 as CSI part 2 and replacing $β\_{offset}^{PUSCH}$ by $β\_{offset}^{CSI-part1}$, taking HARQ-ACK with priority index 0 as CSI-part 1 and taking HARQ-ACK with priority index 1 as HARQ-ACK, if CSI part 1 is also transmitted on the PUSCH and the PUSCH is associated with priority index 0.If *uci-MuxWithDiffPrio* is configured, and CG-UCI associated with priority index 0 and HARQ-ACK bits associated with priority index 0 if any, HARQ-ACK bits associated with priority index 1, and CSI part 1 if any are transmitted on a PUSCH associated with priority index 0:- Perform rate matching for HARQ-ACK with priority index 1 according to clause 6.3.2.4.2.1, by taking HARQ-ACK with priority index 1 as HARQ-ACK and replacing $β\_{offset}^{PUSCH}$ by $β\_{offset}^{HARQ-ACK-HP}$.- Perform rate matching for CG-UCI associated with priority index 0 according to clause 6.3.2.4.2.2, if CG-UCI associated with priority index 0 is transmitted without HARQ-ACK bits associated with priority index 0, by taking CG-UCI associated with priority index 0 as CSI-part 1 and replacing $β\_{offset}^{PUSCH}$ by $β\_{offset}^{CG-UCI},$ and taking HARQ-ACK with priority index 1 as HARQ-ACK.- Perform rate matching for CG-UCI associated with priority index 0 and HARQ-ACK bits associated with priority index 0 according to clause 6.3.2.4.2.2, if both CG-UCI associated with priority index 0 and HARQ-ACK bits associated with priority index 0 are transmitted, by taking CG-UCI associated with priority index 0 and HARQ-ACK bits associated with priority index 0 as CSI-part 1 and replacing $β\_{offset}^{PUSCH}$ by $β\_{offset}^{HARQ-ACK-LP},$ and taking HARQ-ACK with priority index 1 as HARQ-ACK.- Perform rate matching for CSI part 1 according to clause 6.3.2.4.2.3, by taking CSI part 1 as CSI part 2 and replacing $β\_{offset}^{PUSCH}$ by $β\_{offset}^{CSI-part1}$, taking CG-UCI associated with priority index 0 and HARQ-ACK bits associated with priority index 0 if any as CSI-part 1 and taking HARQ-ACK with priority index 1 as HARQ-ACK, if CSI part 1 is also transmitted on the PUSCH and the PUSCH is associated with priority index 0. |

Regarding the second comment from QC and Ericsson, we agree.For comment 3 from Ericsson, we are fine with the suggestion. |
| Ericsson2 | Thanks DCM for clarification regarding our **Comment 1**. Indeed description in this clause is applicable when joint coding is performed between CG-UCI/UTO-UCI and HARQ-ACK. Thanks! |
| vivo | Thanks for the draft CR. We have following comments on the CR.**Comment 1:**For the text in section 9, we suggest to add condition for UTO-UCI, to distinguish UTO-UCI and CG-UCI.

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| When a UE would multiplex HARQ-ACK information in a PUSCH transmission that is configured by a *ConfiguredGrantConfig* and includes UTO-UCI if the UE is provided by *nrof\_UTO\_UCI*, or includes CG-UCI if the UE is provided *cg-UCI-Multiplexing*, the UE multiplexes the HARQ-ACK information in the PUSCH transmission; otherwise, if the HARQ-ACK information and the PUSCH have same priority index, the UE does not transmit the PUSCH and multiplexes the HARQ-ACK information in a PUCCH transmission or in another PUSCH transmission; if the HARQ-ACK information and the PUSCH have different priority indexes, the UE does not transmit the channel with the smaller priority index.  |

**Comment 2:**For the text of first paragraph in section 9.3.1, it has implication that UTO-UCI is conditioned on “*nrofSlots\_InCGperiod*” is configured. Note there is no agreement on this dependency between UTO-UCI and multi-PUSCH CGs in RAN1. So, we suggest to remove the first sentence of this paragraph, which is not related to the procedure of reporting UTO-UCI.**Comment 3:**For the text of second paragraph in section 9.3.1, according to agreement and the conclusion, it should be clarified in the spec that UTO-UCI is applied to the $N\_{TO}$ consecutive and valid CG PUSCH TOs starting from the end of the transmitted CG PUSCH carrying the UTO-UCI. So we suggest the following modification.

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| **Agreement*** Configure the RRC parameter Nu (Nu is the size of bit-map)
	+ FFS range value of Nu
* UTO\_offset is the offset value.
	+ Alt-1: UTO\_Offset is provided by configuration.
		- FFS range value of UTO\_offset
	+ Alt-2: UTO\_Offset = 0
* A transmitted CG PUSCH, carries UTO-UCI that is applicable to the Nu consecutive and valid CG PUSCH TOs, starting with UTO\_offset from the end of the transmitted CG PUSCH.

**Conclusion**There is no consensus to introduce RRC parameter UTO\_offset. This over-rides earlier RAN1 agreements. |

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| 9.3.1 UE procedure for reporting UTO-UCI~~A UE can be indicated, by~~ *~~nrofSlots\_InCGperiod~~* ~~in~~ *~~configuredGrantConfig~~*~~, more than one TO for CG-PUSCH transmission within a period of a CG-PUSCH configuration [6, TS 38.214].~~ If ~~the~~ a UE is ~~also~~ provided *nrof\_UTO\_UCI* with value equal to $N\_{TO}$, the UE multiplexes UTO-UCI represented by a bitmap of $N\_{TO}$ bits in each CG-PUSCH transmission for the CG-PUSCH configuration. The UTO-UCI of $N\_{TO}$ bits has a one-to-one mapping to $N\_{TO}$ subsequent CG-PUSCH TOs, starting from the end of the transmitted CG PUSCH carrying the UTO-UCI. For unpaired spectrum operation, the $N\_{TO}$ subsequent CG-PUSCH TOs exclude invalid ones where a UE does not transmit a PUSCH based on the procedures in Clause 11.1. A bit value of ‘0’ indicates that the UE may transmit CG-PUSCH, and a bit value of ‘1’ indicates that the UE will not transmit CG-PUSCH, in a corresponding CG-PUSCH TO. When the UE indicates by UTO-UCI a value of ‘1’ for a CG-PUSCH TO, the UE continues to indicate the value of ‘1’ for the CG-PUSCH TO by UTO-UCI multiplexed in subsequent CG-PUSCH transmissions, and the UE does not transmit CG-PUSCH in the CG-PUSCH TO.  |

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