**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 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 which provides indexes and for the UE to use if the UE multiplexes up to 11, and more than 11 combined information bits, respectively.  |

[Aris]: There seems to be a confusion of what priority is. This is not about multiplexing priority, as described in 38.212, but about UCI priority (the current values 0 and 1). A similar statement was captured as part of the UTO-UCI discussions (see also response to Ericsson) and, for uniformity and clarity, it was added for CG-UCI. No need for a Rel-17 CR to clarify, but would be good to have that clarification from Rel-18 given a similar statement for UTO-UCI. 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 , the UE multiplexes UTO-UCI represented by a bitmap of bits in each CG-PUSCH transmission for the CG-PUSCH configuration.  |

[Aris]: RAN1 discussed UTO-UCI under the “multi-PUSCH” CG. Any enhancements to legacy CG were not in scope and were not discussed. Also, please note that the WI is closed (i.e. no discussion on features that are not currently supported). However, agreements on UTO-UCI do not explicitly mention “multi-PUSCH” CG. Based on that, an update will be made. It will be good for RAN1 to clarify whether it was intended for UTO-UCI to have legacy applicability.  |
| 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).[Aris]: The intention of the statement is misunderstood. It is not about multiplexing UCI of different priorities in a PUSCH. It is about defining the priority of a UTO-UCI in a CG-PUSCH – just to say it is same as that of CG-PUSCH and to capture the following**Agreement – RAN1#112bis**With respect to PHY two-level priority, for a configured grant PUSCH configuration, the “UTO-UCI” has the same priority level as the configured grant PUSCH.**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 in *configuredGrantConfig* of a CG-PUSCH configuration [6, TS 38.214],  the UE multiplexes UTO-UCI represented by a bitmap of bits in each CG-PUSCH transmission for the CG-PUSCH configuration. [Aris]: Please see response to QC. OK to update as above but it will be proper for RAN1 to have a conclusion on the applicability of UTO-UCI on legacy CGs.**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 bits has a one-to-one mapping to subsequent CG-PUSCH TOs.[Aris]: OK. Will introduce as it is also referred to from 38.212 – e.g.“The bits of UTO-UCI, , have a one-to-one mapping to subsequent CG-PUSCH TOs in ascending order of start time.” |
| 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 by , 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 by .- 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 by , 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 by 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 by , 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 by .- 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 by 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 by 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 by , 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. |

[Aris]: Agree – thank you for the lengthy explanation, it is unfortunate it was needed for something that is rather simple. Regarding the second comment from QC and Ericsson, we agree.For comment 3 from Ericsson, we are fine with the suggestion.[Aris]: Please see previous responses.  |
| 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.  |

[Aris]: Actually, including UTO-UCI in that paragraph is incorrect and will be removed. That paragraph is specific to CG-UCI (i.e. dropping the PUSCH when the UE needs to report HARQ-ACK the UE is not provided *cg-UCI-Multiplexing*).**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.[Aris]: Please see previous responses to the same comment.**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 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 , the UE multiplexes UTO-UCI represented by a bitmap of bits in each CG-PUSCH transmission for the CG-PUSCH configuration. The UTO-UCI of bits has a one-to-one mapping to subsequent CG-PUSCH TOs, starting from the end of the transmitted CG PUSCH carrying the UTO-UCI. For unpaired spectrum operation, the 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.  |

[Aris]: I don’t think the change is needed – it should be clear what “subsequent CG-PUSCH TOs” are and there is no notion of an offset in the text.  |
| Nokia, NSB | **Comment 1:** A general comment that the parameter names should be placed in square brackets, until RAN2 has concluded their work and confirms the names of parameters.[Aris]: There is no use of [ ] in 38.213. Alignment of all RRC parameters (not only for XR) will happen later following usual procedures. **Comment 2:** The following part is confusing: “or includes CG-UCI if the UE is provided *cg-UCI-Multiplexing*”. It reads as CG-UCI is included if provided with cg-UCI multiplexing. Shall we change the wording to e.g.: “or includes CG-UCI and the UE is provided *cg-UCI-Multiplexing*”

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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, 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. |

[Aris]: That change will be reverted – it was not correct to include UTO-UCI in that paragraph – please see response to Vivo. **Comment 3:** Related to changes to CG-UCI. We agree with Docomo and Editor on the following statement: Priority values of the CG-UCI and of the PUSCH are same.Please find the agreement from RAN1#109: **Agreement**

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| RAN1#109: **Agreement**When *cg-UCI-Multiplexing* is enabled, for PUSCH with CG UCI multiplexing with HARQ-ACK, if any,* CG-UCI has the same priority as the PUSCH.
* Treat the CG-UCI of a certain priority as if a HARQ-ACK of the same priority.
* Joint encode CG-UCI with HARQ-ACK of the same priority if it exists.
* Then reuse the existing multiplexing rules.
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However, while these changes seem to be good for general readability, they do not directly relate to the XR work and wonder if they should be handled as a part of a separate editorial CR:

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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 ~~if the UE is~~ using a value provided by *betaOffsetCG-UCI* ~~a value, from a set of values,~~ with the mapping defined in Table 9.3-1. Priority values of the CG-UCI and of the PUSCH are same. 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 which provides indexes and for the UE to use if the UE multiplexes up to 11, and more than 11 combined information bits, respectively. |

[Aris]: The purpose is to avoid discussing a Rel-17 CR for CG-UCI (it should be generally understood that the priority of CG-UCI is same as the priority of CG-PUSCH – same as for UTO-UCI) and make the change/clarification from Rel-18. The relation to XR is implicit as part of an alignment of descriptions in 38.213 since that clarification was spelled-out in RAN1 for UTO-UCI.**Comment 4**: On 9.3.1 UE procedure for reporting UTO-UCI. We agree with Qualcomm, Ericsson, vivo that limitation of UTO-UCI to multi-PUSCH CG was not agreed and support the modification proposed by Ericsson in their Comment 2 and 3.[Aris]: Please see previous responses to the same comment. |
| ZTE, Sanechips | **Comment 1:** For Chapter 9.1.3, We have a clarification question. Does the “CG-PUSCH transmission” refers to “PUSCH that is transmitted” in the agreement ?

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| the UE multiplexes UTO-UCI represented by a bitmap of bits in each CG-PUSCH transmission for the CG-PUSCH configuration.  |
| **Agreement*** **Option 1**: For a CG PUSCH configuration, the UTO-UCI is included in **every CG PUSCH that is transmitted** (that is Option 1 in corresponding agreement in RAN1#112)
	+ FFS details

Note: The term “UTO-UCI” refers to the “UCI that provides information about unused CG PUSCH transmission occasions” for convenience. |

[Aris]: Yes. **Comment 2:** Regardingactivation and release for Type-2 Multi-PUSCHs CGWe’d like to clarify whether or not multi-PUSCHs configured UL grant Type 2 are captured in section 10.2. If not, following change can be considered.

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| 10.2 PDCCH validation for DL SPS and UL grant Type 2A UE validates, for scheduling activation or scheduling release, a DL SPS assignment PDCCH or a configured UL grant Type 2 PDCCH or a multi-PUSCHs configured UL grant Type 2 PDCCH referred in [TS 38.321] if\*\*\* Unchanged parts are omitted \*\*\* |

[Aris]: I don’t think “multi-PUSCH” CG is different than “single-PUSCH” CG – they are both provided by *configuredGrantConfig* (there is also no such thing as “multi-PUSCH” in the specifications but that is secondary).**Comment 3:** For Chapter 9:As vivo/Nokia also commented, similar as underlined description of CG-UCI, we suggest to have the change:

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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. |

[Aris]: Please see response to Vivo.  |
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