3GPP TSG-RAN WG1 Meeting #114bis R1-23xxxxx

Xiamen, China, October 9th – 13th 2023

Agenda Item: 8.6.1

Source: Moderator (Ericsson)

Title: Moderator Summary#1 – Maintenance of XR Enhancements

Document for: Discussion, Decision

# 1 Introduction

In RAN plenary 98-e, the Rel-18 WI on eXtended Reality (XR) was agreed and was further revised in RAN#99, with the following objectives:

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| Specify the enhancements related to power saving:  - DRX support of XR frame rates corresponding to non-integer periodicities (through at least semi-static mechanisms e.g. RRC signalling) (RAN2).  Specify the enhancements related to capacity:  - Multiple Configured Grant (CG) PUSCH transmission occasions in a period of a single CG PUSCH configuration (RAN1, RAN2);  - Dynamic indication of unused CG PUSCH occasion(s) based on Uplink Control Information (UCI) by the UE (RAN1, RAN2);  - Buffer Status Report (BSR) enhancements including at least new Buffer Status Table(s) (RAN2);  - Delay reporting of buffered data in uplink (RAN2);  - Discard operation of PDU Sets for DL and UL (RAN2, RAN3);  Specify the enhancements for XR Awareness:  - Signalling by CN of semi-static information per QoS flow (e.g. PDU set QoS parameters), dynamic information per PDU set (PDU Set information and Identification) and End of Data Burst indication (RAN3, RAN2);  - Impact of identifying by UE of PDU Sets, Data bursts and PSI, as needed (RAN2);  - Provisioning by UE of XR traffic assistance information e.g. periodicity, UL traffic arrival information (RAN2, RAN3);  - Support signalling the congestion information from RAN to the CN in alignment with SA2 (RAN3); |

The normative work in RAN1 was completed in previous meeting. The first version of the specifications for introducing the XR capacity enhancements features were endorsed in RAN plenary meeting#101, as well as endorsement of “Resuming PDCCH monitoring after UL NACK”. This meeting, the discussion is focused on the maintenance issues regarding the specified features.

This document provides a summary of the contributions submitted to RAN1#114bis under Agenda item 8.6. It is also intended to facilitate the discussions regarding the topics under with respect to the following assignment by the RAN1 Chair:

[114bis-R18-XR] Email discussion on XR – Sorour (Ericsson)

* To be used for sharing updates on online/offline schedule, details on what is to be discussed in online/offline sessions, tdoc number of the moderator summary for online session, etc

# 2 Maintenance issues

This section captures the summary of the discussions regarding the design aspects of the following WID objective:

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| - Multiple CG PUSCH transmission occasions in a period of a single CG PUSCH configuration (RAN1, RAN2); |

## 2.1 Issue#1: Description of valid/invalid CG PUSCHs

This issue is raised by the following companies:

* Spreadtrum, Nokia/NSB, OPPO

Description of “valid/invalid” CG PUSCH is used for design of two features developed under XR WI.

* HARQ process ID determination based on increment for valid multi-PUSCHs CG
* UTO-UCI indication for valid CG PUSCHs

The corresponding agreements in RAN1 include the following note to determine valid/invalid CG PUSCHs.

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| Note: A configured CG PUSCH is invalid if the CG PUSCH is dropped due to collision with DL symbol(s) indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated or SSB*. Otherwise, it is valid. |

Description of “valid/invalid” CG PUSCH is used for specification of two features developed under XR WI by referring to the procedures in Clause 11.1 of TS 38.213.

Couple of companies discuss that the description of invalid CG PUSCH is not clearly defined by using the reference to clause 11.1. They reason that clause 11.1 of 38.213, involves other cases such as cancellation by dynamic scheduling and it is not clear how to distinguish these cases from the cases captured in the note above of the agreement. Therefore, they propose to clarify this issue and update the specifications accordingly to capture only the cases mentioned in the note above.

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| Spreadtrum | **Proposal 2: Adopt the following TP for section 6.1.2.3 in TS 38.214.**   |  |  | | --- | --- | | Reason for change | The definition of an invalid CG PUSCH have not been clearly captured in the RAN1 specifications. | | Summary of change | 6.1.2.3 Resource allocation for uplink transmission with configured grant  If at least one of the symbols indicated by the indexed row of the used resource allocation table in the slot overlaps with a DL symbol indicated by tdd-UL-DL-ConfigurationCommon or tdd-UL-DL-ConfigurationDedicated if provided, or a symbol of an SS/PBCH block with index provided by ssb-PositionsInBurst, the configured PUSCH grant is invalid, otherwise it is valid. | | Consequences if not approved | The definition of an invalid CG PUSCH is not clear. | | Text proposal | TS 38.214  6.1.2.3 Resource allocation for uplink transmission with configured grant  \*\*\*\*\*\*\*\*\*\*\*\*\*\* Unchanged parts omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\*  If at least one of the symbols indicated by the indexed row of the used resource allocation table in the slot overlaps with a DL symbol indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, or a symbol of an SS/PBCH block with index provided by *ssb-PositionsInBurst*, the configured PUSCH grant is invalid, otherwise it is valid.  \*\*\*\*\*\*\*\*\*\*\*\*\*\* Unchanged parts omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\* | |
| Nokia/NSB | **Proposal 2: RAN1 to clarify whether all cases from clause 11.1 and subclause 11.1.1 of TS 38.213 are considered as invalid occasions or only the part indicated in the note of the agreement.**   * If it is clarified by RAN1 that the valid/invalid definition is based on collision to DL symbol(s) indicated by tdd-UL-DL-ConfigurationCommon or tdd-UL-DL-ConfigurationDedicated or SSB symbols, following TP could be considered to TS 38.214:   **Proposal 3**: **Consider the following TP for TS 38.214:**   |  | | --- | | **<omitted text>**  When *[nrofSlots\_InCGperiod]* is configured for Type 1 configured grant or Type 2 configured grant, HARQ process ID for the Kth (1 < K ≤ [*nrofSlots\_InCGperiod]*) valid configured PUSCH grant is determined as in clause 5.4.1 of [10, TS 38.321], excluding invalid configured PUSCH grant(s) that are not transmitted based on collision with DL symbol(s) indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* or SSB symbols, as described in clause 11.1 of [6, TS 38.213].  **<omitted text>** | |
| OPPO | **Proposal 2: RAN1 discusses further the misalignment between RAN1 agreement and TS38.213 CR for the definition of “invalid CG-PUSCH TO”.**   * **Our preference is to revise the current TS38.213 CR to align with RAN1 agreement, or to at least avoid making it depending on a dynamic condition.**   TS 38.213 clause 11.1, which includes the dismiss of PUSCH transmission even without colliding with semi-static DL symbol or DL symbol used for SSB. The referred TS38.213 texts in section 11.1 include:   |  | | --- | | [Text 1: the highlighted text below does not involve semi-static DL symbol or SSB, but triggers UE not to transmit PUSCH. ]  If a UE  - is configured with multiple serving cells and is provided with *directionalCollisionHandling-r16* = 'enabled' for a set of serving cell(s) among the multiple serving cells, and  - indicates support of *half-DuplexTDD-CA-SameSCS-r16* capability, and  - is not configured to monitor PDCCH for detection of DCI format 2\_0 on any of the multiple serving cells,  for a set of symbols of a slot that are indicated to the UE for reception of SS/PBCH blocks in a first cell of the multiple serving cells by *ssb-PositionsInBurst* in *SystemInformationBlockType1* or by *ssb-PositionsInBurst* in *ServingCellConfigCommon* or, if the UE is not provided *dl-OrJointTCI-StateList*, by *ssb-PositionsInBurst* in *SSB-MTCAdditionalPCI* associated to physical cell ID with active TCI states for PDCCH or PDSCH, or for a set of symbols of a slot corresponding to SS/PBCH blocks configured for L1 beam measurement/reporting, the UE does not transmit PUSCH, PUCCH, or PRACH in the slot if a transmission would overlap with any symbol from the set of symbols, and the UE does not transmit SRS in the set of symbols of the slot in  - any of the multiple serving cells if the UE is not capable of simultaneous transmission and reception as indicated by *simultaneousRxTxInterBandCA* among the multiple serving cells, and  - any one of the cells corresponding to the same band as the first cell, irrespective of any capability indicated by *simultaneousRxTxInterBandCA*.  [Text 2: the highlighted text below does not involve semi-static DL symbol or SSB, but triggers UE not to transmit CG-PUSCH.]  ......  and regardless of whether the reference cell and another cell operate in same or different frequency bands,  the UE  - does not expect *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* for the reference cell to indicate a symbol as uplink and to detect a DCI format scheduling a reception on the symbol on another cell  - does not expect to be configured by higher layers to transmit SRS, PUCCH, PUSCH, or PRACH on a flexible symbol on the reference cell and to detect a DCI format scheduling a reception on the symbol on another cell  - does not transmit a PUCCH, PUSCH or PRACH that is configured by higher layers on a set of symbols on another cell if at least one symbol from the set of symbols is indicated as downlink by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* or is a symbol corresponding to a PDCCH, PDSCH, or CSI-RS reception that is configured by higher layers on the reference cell |   What’s more, the current texts in clause 11.1 of TS38.213 also contain the cases of “canceling PUSCH transmission” due to various conditions, even including the dynamic conditions, for example,   |  | | --- | | [Text 3: the highlighted text below does not involve semi-static DL symbol or SSB, but triggers UE to cancel CG-PUSCH transmission (i.e., not to transmit CG-PUSCH) based on a dynamic condition on ]  For operation on a single carrier in unpaired spectrum, if a UE is configured by higher layers to transmit SRS, or PUCCH, or PUSCH, or PRACH in a set of symbols of a slot and the UE detects a DCI format indicating to the UE to receive CSI-RS or PDSCH in a subset of symbols from the set of symbols, then  - If the UE does not indicate the capability of [partialCancellation], the UE does not expect to cancel the transmission of the PUCCH or PUSCH or PRACH in the set of symbols if the first symbol in the set occurs within relative to a last symbol of a CORESET where the UE detects the DCI format; otherwise, the UE cancels the PUCCH, or the PUSCH, or an actual repetition of the PUSCH [6, TS 38.214], determined from clauses 9, 9.2.5 and 9.2.6 or clause 6.1 of [6, TS 38.214], or the PRACH transmission in the set of symbols. | |

Moderator’s comment: It seems the issue is valid and it is good to clarify. Moderator suggests to adopt the following suggested TPs based on the proposed ones above to describe the applicable cases in clause 11.1.

**Proposed TP1-1 of 38.214:**

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| **<omitted text>**  When *[nrofSlots\_InCGperiod]* is configured for Type 1 configured grant or Type 2 configured grant, HARQ process ID for the Kth (1 < K ≤ [*nrofSlots\_InCGperiod]*) valid configured PUSCH grant is determined as in clause 5.4.1 of [10, TS 38.321], excluding invalid configured PUSCH grant(s) that are not transmitted. A configured PUSCH grant(s) is invalid if at least one its symbol overlaps with a DL symbol indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, or a symbol of an SS/PBCH block with index provided by *ssb-PositionsInBurst*, otherwise it is valid., as described in clause 11.1 of [6, TS 38.213].  **<omitted text>** |

**Proposed TP1-2 of 38.213:**

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| TS 38.214  6.1.2.3 Resource allocation for uplink transmission with configured grant  \*\*\*\*\*\*\*\*\*\*\*\*\*\* Unchanged parts omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\*  If at least one of the symbols indicated by the indexed row of the used resource allocation table in the slot overlaps with a DL symbol indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, or a symbol of an SS/PBCH block with index provided by *ssb-PositionsInBurst*, the configured PUSCH grant is invalid, otherwise it is valid.  \*\*\*\*\*\*\*\*\*\*\*\*\*\* Unchanged parts omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\* |

### Initial discussion

**Question:** What is your view about the issue raised above and the corresponding proposal, as well as Moderator’s comment? Please share your view on improving the TP1-1 and TP1-2, if needed.

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## Issue#2: Multi-PUSCH CG and unlicensed operation

Ericsson proposes the following:

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| ***Reason for change:*** | The specification of Rel-18 feature of multiple PUSCH transmisison occasion in a period of a configured grant configuraiton by the higher layer parameter [*nrofSlots\_InCGperiod*] allows the applicability of this feature for shared spectrum. The reason is that a configured grant in shared spectrum can not be configured without *cg-nrofSlots* and *cg-nrofPUSCH-InSlot* in the *configuredGrantConfig*. Introducing this feature for shared spectrum is unnecessary since the same functionality is achieved by configuring *cg-nrofSlots* and *cg-nrofPUSCH-InSlot* in the *configuredGrantConfig*. Hence, the support of this feature can be limited to operation in licensed spectrum. |
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| ***Summary of change:*** | Clarify that the [*nrofSlots\_InCGperiod*] is not applicable to operation on shared spectrum. |
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| ***Consequences if not approved:*** | Two features for with the same functionality are supported for operation in shared spectrum. |
| 6.1.2.3 Resource allocation for uplink transmission with configured grant \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchnaged text omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  A set of allowed periodicities *P* are defined in [12, TS 38.331]. The higher layer parameter *cg-nrofSlots*, provides the number of consecutive slots allocated within a configured grant period. The higher layer parameter *cg-nrofPUSCH-InSlot* provides the number of consecutive PUSCH allocations within a slot, where the first PUSCH allocation follows the higher layer parameter *timeDomainAllocation* for Type 1 PUSCH transmission or the higher layer configuration according to [10, TS 38.321], and UL grant received on the DCI for Type 2 PUSCH transmissions, and the remaining PUSCH allocations have the same length and PUSCH mapping type, and are appended following the previous allocations without any gaps. The higher layer parameter *[nrofSlots\_InCGperiod]* provides the number of consecutive slots allocated within a configured grant period. The same combination of start symbol and length and PUSCH mapping type repeats over the consecutively allocated slots. If [*nrofSlots\_InCGperiod*] is configured, the PUSCH allocation in each consecutive slot follows the higher layer parameter *timeDomainAllocation* for Type 1 PUSCH transmission or the higher layer configuration according to [10, TS 38.321], and UL grant received in the DCI for Type 2 PUSCH transmissions. ~~If a~~ A UE does not expect to be ~~is~~ configured with higher layer parameter [*nrofSlots\_InCGperiod*] in a *configuredGrantConfig* for operation on shared spectrum~~, the UE does not expect to be configured with~~ *~~cg-nrofSlots~~* ~~and~~ *~~cg-nrofPUSCH-InSlot~~* ~~in the~~ *~~configuredGrantConfig~~*.  \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchnaged text omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* | |

CATT, in related to HARQ process ID determination, proposes the following:

**Proposal 2: It should be specified that the parameter *N ([nrofSlots\_InCGperiod])* configuration is not expected to be configured with *cgRetransmissionTimer* in the *configuredGrantConfig* simultaneously. The following TP in TS 38.214 should be adopted.**

**Proposed TP for TS 38.214**

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| 6.1 UE procedure for transmitting the physical uplink shared channel  <omitted text>  When *[nrofSlots\_InCGperiod]* is configured for Type 1 configured grant or Type 2 configured grant and *cg-RetransmissionTimer* is not provided, HARQ process ID for the Kth (1 < K ≤ [*nrofSlots\_InCGperiod]*) valid configured PUSCH grant is determined as in clause 5.4.1 of [10, TS 38.321], excluding invalid configured PUSCH grant(s) that are not transmitted as described in clause 11.1 of [6, TS 38.213].  <omitted text>  6.1.2.3 Resource allocation for uplink transmission with configured grant  <omitted text>  A set of allowed periodicities *P* are defined in [12, TS 38.331]. The higher layer parameter *cg-nrofSlots*,provides the number of consecutive slots allocated within a configured grant period. The higher layer parameter *cg-nrofPUSCH-InSlot* provides the number of consecutive PUSCH allocations within a slot, where the first PUSCH allocation follows the higher layer parameter *timeDomainAllocation* for Type 1 PUSCH transmission or the higher layer configuration according to [10, TS 38.321], and UL grant received on the DCI for Type 2 PUSCH transmissions, and the remaining PUSCH allocations have the same length and PUSCH mapping type, and are appended following the previous allocations without any gaps. The higher layer parameter *[nrofSlots\_InCGperiod]* provides the number of consecutive slots allocated within a configured grant period. The same combination of start symbol and length and PUSCH mapping type repeats over the consecutively allocated slots. If [*nrofSlots\_InCGperiod*] is configured, the PUSCH allocation in each consecutive slot follows the higher layer parameter *timeDomainAllocation* for Type 1 PUSCH transmission or the higher layer configuration according to [10, TS 38.321], and UL grant received in the DCI for Type 2 PUSCH transmissions. If a UE is configured with higher layer parameter [*nrofSlots\_InCGperiod*] in a *configuredGrantConfig*, the UE does not expect to be configured with *cg-nrofSlots*, *cg-nrofPUSCH-InSlot* and *cg-RetransmissionTimer* in the *configuredGrantConfig*.  <omitted text> |

**Moderator’s comment:** The issue seems to be valid.

The proposed TP can be improved. Since the configuration of *cg-nrofSlots* and *cg-nrofPUSCH-InSlot* is conditioned on configuration of *cg-RetransmissionTimer*, it seems the first change in the proposed TP by CATT is not needed if the second change is of CATT TP is OK, but a bit redundant and can be improved as the following:

“… If a UE is configured with higher layer parameter [*nrofSlots\_InCGperiod*] in a *configuredGrantConfig*, the UE does not expect to be configured with *~~cg-nrofSlots~~*~~,~~ *~~cg-nrofPUSCH-InSlot~~* *cg-RetransmissionTimer* in the *configuredGrantConfig*.”

Alternatively, Ericsson’s TP achieve the same goal.

Hence Moderator’s recommendation is either to adopt Ericsson’s TP, or adopt the improved TP based on CATTs’ TP.

* Note: TP2-1A does not exclude the operation on unlicensed. But ensures CG PUSCH does not include CG-UCI, and also HARQ process ID determination is not based on UE implementation.
* Note: TP2-1B does exclude the operation on unlicensed. And consequently, ensures CG PUSCH does not include CG-UCI, and also HARQ process ID determination is not based on UE implementation.

**Proposed TP2-1A for Clause X of 38.214:**

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| **<omitted text>**   |  | | --- | | If a UE is configured with higher layer parameter [*nrofSlots\_InCGperiod*] in a *configuredGrantConfig*, the UE does not expect to be configured with *~~cg-nrofSlots~~*~~,~~ *~~cg-nrofPUSCH-InSlot~~* *cg-RetransmissionTimer* in the *configuredGrantConfig*. | |  |   **<omitted text>** |

**Proposed TP2-1B for Clause X of 38.214:**

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| **<omitted text>**   |  | | --- | |  | | ~~If a~~ A UE does not expect to be ~~is~~ configured with higher layer parameter [*nrofSlots\_InCGperiod*] in a *configuredGrantConfig* for operation on shared spectrum~~, the UE does not expect to be configured with~~ *~~cg-nrofSlots~~* ~~and~~ *~~cg-nrofPUSCH-InSlot~~* ~~in the~~ *~~configuredGrantConfig~~*. |   **<omitted text>** |

### 2.2.1 Initial discussion

**Question:** What is your view about the issue raised above and the corresponding proposal, as well as Moderator’s comment? Please share your view on improving the **TP2-1A and TP2-1B**, if needed.

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## 2.3 Issue#3: Incomplete references for multi-PUSCHs CG

Huawei and CMCC proposes the following:

**Proposed TP3-1 for Clause** 6.3.2.1.3A **of 38.212**

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| **Reason for change:**  In TS 38.212 [1], there are two “given by clause x.x of [5, TS 38.213]” in Clause 6.3.2.1.3A and Clause 6.3.2.1.5. As the corresponding clause has been updated in TS 38.213 [2], the incomplete parts in TS 38.212 should be fixed.  **Summary of change:**  Fix the two incomplete clause references of TS 38.213 in TS 38.212.  **Consequence if not approved:**  The references in specifications are unclear.  ***Proposal 1:*** ***Fix the two incomplete clause references of TS 38.213 in TS 38.212.***  We provide the Text Proposal for section 6.3.2.1.3A and section 6.3.2.1.5 of TS 38.212 below:  ---------------------------- Start of Text Proposal for TS 38.212 -----------------------------  < Unchanged parts are omitted >  6.3.2.1.3A UTO-UCI  For UTO-UCI bits transmitted on a CG PUSCH when the higher layer parameter *nrof\_UTO\_UCI* is configured, the UTO-UCI bit sequence is determined as follows:  - set for and , where is provided by *nrof\_UTO\_UCI*, and the UTO-UCI bit sequence is given by clause 9.3.1 of [5, TS 38.213].  6.3.2.1.5 UCI with different priority indexes  If the higher layer parameter *nrof\_UTO\_UCI* is configured, the procedure in this clause 6.3.2.1.5 applies by replacing CG-UCI with UTO-UCI in all the notations and texts, and replacing "is given by Table 6.3.2.1.3-1 mapped in the order from upper part to lower part" with "is given by clause 9.3.1 of [5, TS 38.213]".  --------------------------------------- End of Text Proposal ---------------------------------- |

Moderator’s comment: Adopt the proposed change in TP3-1.

### 2.3.1 Initial discussion

**Question:** What is your view about the issue raised above and the corresponding proposal, as well as Moderator’s comment to adopt TP3-1?

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## 2.4 Issue#4: UTO-UCI encoding with different priorities

Samsung proposes the following:

* Observation 1: Existing specifications for UTO-UCI multiplexing are complete including the case of overlapping among PUSCHs/PUCCHs with different priorities.

Nokia/NSB proposes the following:

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| We propose to clarify that only when UTO-UCI and HARQ-ACK are with the same priority index, they can be jointly encoded. And in case UTO-UCI and HARQ-ACK are with different priority indexes, separate encoding should be applied.  **Proposal 4**: Since joint encoding of UTO-UCI and HARQ-ACK is supported when UTO-UCI and HARQ-ACK are same priority consider the following editorial TP for TS 38.212:  **<omitted text>**  6.3.2.1.4 HARQ-ACK and CG-UCI/UTO-UCI with the same priority index  If the higher layer parameter *nrof\_UTO\_UCI* is configured, the procedure in this clause 6.3.2.1.4 applies by replacing CG-UCI with UTO-UCI in all the notations and texts, and replacing "When higher layer parameter *cg-UCI-Multiplexing* is configured" with "When UTO-UCI and HARQ-ACK are transmitted on a PUSCH".  **<omitted text>** |

ZTE proposes the following (please review the TPs in the company’s contribution):

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| Summary of the TPs (**TP#3, TP#4** and **TP#5** in **Appendix** of R1-2309180.):  As discussed in Rel-18 XR WI, the encoding and multiplexing procedure of UTO-UCI reuses those of CG-UCI. However, there would be some difference between the encoding and multiplexing procedure of UTO-UCI and that of CG-UCI in UCI encoded by Polar code. For instance, if there is not joint encoding of UTO-UCI and HARQ-ACK on CG PUSCH, the UTO-UCI would not be encoded by Polar coding. To this end, we suggest to add additional paragraphs for the encoding and multiplexing procedure of UTO-UCI as shown in **TP#3**.  For the UCI encoded by channel coding of small block lengths, the encoding and multiplexing procedure is the same as that of CG-UCI. As a result, the procedure can be reused by replacing CG-UCI with UTO-UCI as shown in **TP#4**.  In addition, In RAN1#113 meeting, it was agreed that the priority index of UTO-UCI was the same as that of CG PUSCH. However, in clause 6.3.2.7, the replacement would cause confusion of combination of different priorities between UTO-UCI and CG PUSCH. Therefore, we think an additional paragraph should be added in clause 6.3.2.7 for the multiplexing of the UTO-UCI and other UCI with different priorities as shown in **TP#5**. |

**Moderator comment:** It seems companies have different views on whether the specification is complete regarding encoding of HARQ-ACK and UTO-UCI with the same or different priorities when corresponding PUSCH and PUCCH overlap. Discussion is needed on this topic.

### 2.4.1 Initial discussion

**Question:** What is your view about the status of specification regarding the same or different priorities between UTO-UCI and HARQ-ACK? What is your view about the proposed TPs?

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## 2.5 Issue#5: UTO-UCI encoded by Polar codes

ZTE and CMCC describe that specification is missing when UTO-UCI is jointly encoded by HARQ-ACK using Polar codes when the length would be more than 11 bits.

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| 6.3.2.2 Code block segmentation and CRC attachment  Denote the bits of the payload by , where *A* is the payload size. The procedure in 6.3.2.2.1 applies for and the procedure in Clause 6.3.2.2.2 applies for.  6.3.2.2.1 UCI encoded by Polar code  Code block segmentation and CRC attachment is performed according to Clause 6.3.1.2.1.  6.3.2.2.2 UCI encoded by channel coding of small block lengths  The procedure in Clause 6.3.1.2.2 applies. |

CMCC proposes the following TP and motivates:

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| < Unchanged parts are omitted >  6.3.2.4 Rate matching  6.3.2.4.1 UCI encoded by Polar code  If the higher layer parameter *nrof\_UTO\_UCI* is configured, the procedure in this clause except for clause 6.3.2.4.1.4 applies by replacing CG-UCI with UTO-UCI in all the notations and texts, and replacing “where is the number of coded modulation symbols per layer for CG-UCI transmitted on the PUSCH as defined in clause 6.3.2.4.1.4” with “where is the number of coded modulation symbols per layer for UTO-UCI transmitted on the PUSCH as defined in clause 6.3.2.4.2.4”.  < Unchanged parts are omitted > |

ZTE proposes TP#1 and TP#2.

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| Summary of the TPs (**TP#1** and **TP#2** in **Appendix** of R1-2309180.):   1. For UTO-UCI and HARQ-ACK joint encoding by Polar code (i.e., subclause 6.3.2.4.1.5), the procedure of joint encoding of UTO-UCI and HARQ-ACK is the same as that of CG-UCI and HARQ-ACK. As a result, the CG-UCI can be directly replaced by UTO-UCI with the **TP#1** . 2. For UTO-UCI only in channel coding of small block lengths, the replacement would cause wrong reference because of the absent UTO-UCI in Polar coding. As a result, an additional subclause (e.g., 6.3.2.4.2.4A) for UTO-UCI is needed. And the additional subclause 6.3.2.4.2.4A is shown in **TP#2**. |

Moderator comment: It seems this is a valid point. Discussion on TPs are needed.

### 2.5.1 Initial discussion

**Question:** What is your view about the issue on missing cases using Polar code for UTO-UCI? What is your view about the proposed TPs?

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## 2.6 Issue#6: UTO-UCI indication and unlicensed operation

Ericsson discusses that it is not clear from specification whether CG with UTO-UCI is supported by unlicensed, since CG without CG-UCI can be used for unlicensed channel.

Proposal: Decide on one of the following options:

* + Option 1: Indication of UTO-UCI in CG PUSCH transmissions of a CG configuration is not supported for operation on unlicensed.
  + Option 2: Indication of UTO-UCI in CG PUSCH transmissions of a CG configuration is supported for operation on unlicensed band when CG does not include CG-UCI

TPs are proposed for each option are listed below:

Proposed TP6-1 for Clause 9.3 of TS 38.213 corresponding to Option 1

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| ***Reason for change:*** | The indication of UTO-UCI in CG PUSCH transmissions of a CG configuration is not supported for operation on unlicensed.  The current specification in clause 9.3 of 38.213 describes the procedures when either of the CG-UCI or UTO-UCI is multiplexed in a CG PUSCH. It is unclear to determine whether the UTO-UCI is only used for operation on licensed band when CG-UCI is absent, or UTO-UCI can be used for operation on unlicensed bands but for CG configurations without CG-UCI being configured. |
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| ***Summary of change:*** | Add a description to clarify that the indication of UTO-UCI is not applicable to operation in shared spectrum. |
|  |  |
| ***Consequences if not approved:*** | Ambiguty in specification in valid configurations |
| 9.3 UCI reporting in physical uplink shared channel \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchnaged text omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  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.  For a PUSCH transmission that is configured by a *ConfiguredGrantConfig* and includes UTO-UCI, the UE multiplexes the UTO-UCI in the PUSCH transmission using a value provided by *betaOffsetUTO-UCI* with the mapping defined in Table 9.3-1. The UTO-UCI has same priority value as the PUSCH. If the UE multiplexes HARQ-ACK information of same priority value as the UTO-UCI in the PUSCH transmission, as described in clauses 9 and 9.2.5, the UE jointly encodes the HARQ-ACK information and the UTO-UCI and determines a number of resources for multiplexing the combined information in the 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.  For operation on shared spectrum, a UE is not expected a PUSCH transmission that is configured by a *ConfiguredGrantConfig* to include UTO-UCI.  \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchnaged text omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* | |

Proposed TP6-2 for Clause 9.3 of TS 38.213 corresponding to Option 2

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| ***Reason for change:*** | Indication of UTO-UCI in CG PUSCH transmissions of a CG configuration is supported for operation on unlicensed band when CG does not include CG-UCI.  The current specification in clause 9.3 of 38.213 describes the procedures when either of the CG-UCI or UTO-UCI is multiplexed in a CG PUSCH. It is unclear to determine whether the UTO-UCI is supported for operation on unlicensed band when CG-UCI is absent, or UTO-UCI is not supported for operation on unlicensed bands. |
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| ***Summary of change:*** | Add a description to clarify that the indication of UTO-UCI is supported for operation on shared spectrum band when CG does not include CG-UCI. |
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| ***Consequences if not approved:*** | Ambiguty in specification in valid configurations |
| 9.3 UCI reporting in physical uplink shared channel \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchnaged text omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  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.  For a PUSCH transmission that is configured by a *ConfiguredGrantConfig* and includes UTO-UCI, the UE multiplexes the UTO-UCI in the PUSCH transmission using a value provided by *betaOffsetUTO-UCI* with the mapping defined in Table 9.3-1. The UTO-UCI has same priority value as the PUSCH. If the UE multiplexes HARQ-ACK information of same priority value as the UTO-UCI in the PUSCH transmission, as described in clauses 9 and 9.2.5, the UE jointly encodes the HARQ-ACK information and the UTO-UCI and determines a number of resources for multiplexing the combined information in the 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.  For operation on shared spectrum, a PUSCH transmission that is configured by a *ConfiguredGrantConfig* to include UTO-UCI, is not expected to include CG-UCI.  \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchnaged text omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* | |

Moderator’s comment: The issue seems to be valid. It is recommended to discuss to conclude on one of the options and the corresponding TP.

### 2.6.1 Initial discussion

**Question:** What is your view about the issue raised above and the corresponding proposal, as well as Moderator’s comment? Which option do you support? Option 1 or Option 2? What is your view about the corresponding TP, i.e. **TP6-1** or **TP6-2**?

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| Company | Comment |
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## Issue#7: Multi-PUSCH CG other issues

### Issue#7-1: SLIV allocation

Huawei has the following proposal:

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| **Reason for change:**  In NR-U, the higher layer parameter *cg-nrofSlots* provides the number of consecutive slots allocated within a configured grant period. The higher layer parameter *cg-nrofPUSCH-InSlot* provides the number of consecutive PUSCH allocations within a slot. And the PUSCH mapping type repeats over the consecutively allocated slots with the same SLIV. Similarly, the multiple CG PUSCHs in a CG period also have the same SLIV over the consecutively allocated slots.  In clause 6.1.2.3 of the TS 38.214 [3], the higher layer parameter *[nrofSlots\_InCGperiod]* provides the number of consecutive slots allocated within a configured grant period, which has the same meaning as the “PUSCH mapping type repeats over the consecutively allocated slots”. And “the PUSCH allocation in each consecutive slot follows the higher layer parameter *timeDomainAllocation* for Type 1 PUSCH transmission or the higher layer …” also indicates the same meaning as the sentence “The same combination of start symbol and length …”. That is to say, the sentence “The same combination of start symbol and length and PUSCH mapping type repeats over the consecutively allocated slots.” is a duplication of the latter sentence “If [*nrofSlots\_InCGperiod*] is configured, the PUSCH allocation in each consecutive slot follows the higher layer parameter *timeDomainAllocation* for …”. Hence, it is necessary to restrict the sentence “The same combination of start symbol and length and PUSCH mapping type repeats over the consecutively allocated slots” to NR-U scenarios.  **Summary of change:**  Add the limitation “if the higher layer parameter *cg-nrofSlots* is configured” to restrict the sentence “The same combination of start symbol and length and PUSCH mapping type repeats over the consecutively allocated slots.” in NR-U scenarios. And move the sentence “The same combination of start symbol and length and PUSCH mapping type repeats over the consecutively allocated slots.” to the front of the sentence “The higher layer parameter *[nrofSlots\_InCGperiod]*…”.  **Consequence if not approved:**  It will introduce duplication in the description of resource allocation when the higher layer parameter *[nrofSlots\_InCGperiod]* is configured.  ***Proposal 2:*** ***Add the limitation “if the higher layer parameter cg-nrofSlots is configured” to restrict the sentence “The same combination of start symbol and length and PUSCH mapping type repeats over the consecutively allocated slots.” in NR-U scenarios. And move the sentence “The same combination of start symbol and length and PUSCH mapping type repeats over the consecutively allocated slots.” to the front of the sentence “The higher layer parameter [nrofSlots\_InCGperiod]…”.***  We provide the Text Proposal for section 6.1.2.3 of TS 38.214 below:  ---------------------------- Start of Text Proposal for TS 38.214 -----------------------------  **6.1.2.3 Resource allocation for uplink transmission with configured grant**  < Unchanged parts are omitted >  A set of allowed periodicities P are defined in [12, TS 38.331]. The higher layer parameter *cg-nrofSlots*, provides the number of consecutive slots allocated within a configured grant period. The higher layer parameter *cg-nrofPUSCH-InSlot* provides the number of consecutive PUSCH allocations within a slot, where the first PUSCH allocation follows the higher layer parameter *timeDomainAllocation* for Type 1 PUSCH transmission or the higher layer configuration according to [10, TS 38.321], and UL grant received on the DCI for Type 2 PUSCH transmissions, and the remaining PUSCH allocations have the same length and PUSCH mapping type, and are appended following the previous allocations without any gaps. The same combination of start symbol and length and PUSCH mapping type repeats over the consecutively allocated slots if the higher layer parameter *cg-nrofSlots* is configured. The higher layer parameter *[nrofSlots\_InCGperiod]* provides the number of consecutive slots allocated within a configured grant period. If *[nrofSlots\_InCGperiod]* is configured, the PUSCH allocation in each consecutive slot follows the higher layer parameter *timeDomainAllocation* for Type 1 PUSCH transmission or the higher layer configuration according to [10, TS 38.321], and UL grant received in the DCI for Type 2 PUSCH transmissions. If a UE is configured with higher layer parameter *[nrofSlots\_InCGperiod]* in a *configuredGrantConfig*, the UE does not expect to be configured with *cg-nrofSlots* and *cg-nrofPUSCH-InSlot* in the *configuredGrantConfig*.  < Unchanged parts are omitted >  --------------------------------------- End of Text Proposal ---------------------------------- |

Moderator’s comment: In Moderator’s view the proposed change makes the multi-PUSCH CG resource allocation incomplete, while seems redundant for NR-U because of the highlighted text.

### Issue#7-2: UTO-UCI indication dependency on multi-PUSCHs CG

Some companies proposed to clarify the following.

* Vivo, Spreadtrum comm.

**Proposal 1: UTO-UCI can be applicable on both of “multi-PUSCH” CG and the legacy CGs.**

Moderator’s comment: Moderator’s understanding is that the proposal states the current specification and should be reflected in UE feature discussions. If companies see the need, the above can be captured as conclusion.

### Issue#7-3: Related to HARQ process ID for multi-PUSCH CG

CATT has the following proposals:

**Proposal 1: It should be clarified that the procedure of determining HARQ process ID should be associated with the first valid CG PUSCH occasion at the Kth (1 ≤ K ≤ [*nrofSlots\_InCGperiod]*) configured PUSCH if the first configured CG PUSCH occasion is invalid.**

Moderator’s comment: The proposal reverts the agreement where the HARQ process ID is performed for the 1st CG PUSCH, irrespective of being valid/invalid. Also, this approach is the same as legacy. At least it is not clear for moderator the need for the change.

OPPO has the following proposal:

***Proposal 3: A UE doesn’t*** ***expect to be configured in such a way that two or more valid TOs in one period are*** ***associated with the same HARQ process ID.***

Moderator’s comment: If the configuration of CG results in such an association, then corresponding rules should be respected such as out-of-order HARQ. At least it is not clear for moderator the need for new rules.

### 2.7.1 Initial discussion

**Question:** What is your view about the issues raised above (Issue#7-1, 7-2, 7-3) and the corresponding proposal, as well as Moderator’s comment?

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## 2.8 Issue#8: UTO-UCI indication other issues

### Issue#8-1: UTO-UCI indication and CG Repetition

LG states that to support UTO-UCI, we need to consider following regarding de-activation/release:

Proposal 3: Once CG PUSCH has been re-activated (or released), the UTO-UCI previously transmitted before the re-activation (or release), is invalid at least for the CG PUSCH newly activated.

Proposal 4: When CG PUSCH has been re-activated (or released), it is allowed to re-indicate a PUSCH occasion as “not unused” even if the PUSCH occasion was indicated as “unused” before the re-activation (or release).

Moderator’s comment: Moderator’s understanding is that in case of Type 2 CG, the indicated UTO-UCI is valid when the CG is activated as stated in the above proposal. However, if this aspect is not clear, it can be clarified in the spec.

### Issue#8-2: UTO-UCI indication and joint coding

ZTE discusses the following:

In RAN1#114 meeting, there was a conclusion about UTO-UCI and HARQ-ACK joint encoding.

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| **Conclusion**  There is no consensus on the following proposal:  Introduce a new RRC parameter UTO-UCI-Multiplexing (similar to cg-UCI-Multiplexing) to enable/disable joint coding of HARQ-ACK and UTO-UCI in a CG PUSCH with the UTO-UCI. |

There may be a case that the PUSCH carrying UTO-UCI overlaps the PUCCH carrying HARQ-ACK in time domain. But in TS38.213 , UE’s behavior is unclear in this case since there is a lack of a description for whether HARQ-ACK and UTO-UCI are jointly encoded or not when they are multiplexed in the same CG PUSCH. In our opinion, there may be two potential interpretations based on conclusion and agreement:

* Interpretation 1: HARQ-ACK and UTO-UCI are always encoded separately.
* Interpretation 2: HARQ-ACK and UTO-UCI are always jointly encoded.

At the current stage, we think the first interpretation would cause significant spec impacts on 38.212 [1] and TS 38.213, compared to the second interpretation. As a result, we think the second interpretation should be considered and captured in 38.213 as shown in **TP#6**.

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| **TP#6**  \*\*\* Unchanged parts are omitted \*\*\*  When a UE would multiplex HARQ-ACK information in a PUSCH transmission that is configured by a *ConfiguredGrantConfig* and includes CG-UCI [5, TS 38.212], the UE multiplexes the HARQ-ACK information in the PUSCH transmission if the UE is provided *cg-UCI-Multiplexing*; 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.  When a UE would multiplex HARQ-ACK information in a PUSCH transmission that is configured by a *ConfiguredGrantConfig* and if *nrof\_UTO\_UCI* is configured, the UE multiplexes the jointly encoded HARQ-ACK information and UTO-UCI in the PUSCH transmission. |

Moderator’s comment: It is not clear whether there is ambiguity. The basic operation is to multiplex HARq-ACK on PUSCH (here , CG PUSCH). NR-U made an exception by introducing *cg-UCI-Multiplexing*. That exception is specified. But it doesn’t mean that the basic operation needs to be specified due to the exception by NR-U. it is good to discuss to ensure common understanding and no ambiguity in specification.

### Issue#8-3: UTO-UCI indication and no data for CG PUSCH

Sony has the following proposal:

Proposal 3: **If a UE has earlier indicated for an occasion to be used, but there is no data/PUSCH transmission, then the UE should still indicate the UTO-UCI despite transmitting nothing in the data part, i.e., PUSCH with-only UTO-UCI should be transmitted.**

Moderator’s comment: The proposal reverts the agreement that only when a CG PUSCH is transmitted, the UTO-UCI can be carried by the CG PUSCH.

### Issue#8-4: CG PUSCH occasion(s) not indicated by UTO-UCI

Xiaomi has the following observations and proposal:

***Observation 2*: gNB cannot judge whether the TO which is not indicated by UTO-UCI in a multi-PUSCH CG configuration is used by the UE.**

***Observation 3*: It is beneficial for minimizing UTO-UCI overhead to clarify the state of the TO which is not indicated by UTO-UCI in a multi-PUSCH CG configuration.**

***Proposal 2*: gNB should not reuse the TO that has not been indicated by UTO-UCI in a multi-PUSCH CG** **configuration.**

Moderator’s comment: It seems there is a misunderstanding that the bit-map size should fit the number of CG PUSCHs in a period. Please note that the indication is based on the slide window of valid TOs. Also, it is not clear the issue from specification point of view. One of the benefit of the feature is to help the gNB to reuse the CG resources or not, but whether the gNB reuses them or not, is not dependent on this feature and it is up to gNB. Therefore, it is not clear the need for additional specification.

### Issue#8-5: UTO-UCI indication bit mapping

Xiaomi has the following observations and proposal:

***Observation 1*: It will be** **ambiguous about UTO-UCI indication bit mapping once the number of TOs that need to be indicated is less than the bitmap size of the UTO-UCI.**

***Proposal 1*: If the number of TOs that need to be indicated is less than the bitmap size of the UTO-UCI, the first *N* bits in the bitmap of the UTO-UCI are used to indicate TOs, where *N* is the number of TOs that need to be indicated.**

Moderator’s comment: It seems there is a misunderstanding that the bit-map size should fit the number of CG PUSCHs in a period. Please note that the indication is based on the sliding window of valid TOs. Therefore, it is not clear the need for additional specification.

### Issue#8-6: UTO-UCI indication and Handling of Repetition of CG occasion in a period

LG states that to support UTO-UCI with PUSCH repetition, we need to consider following two points:

Proposal 2: When legacy CG configuration is configured with both UTO-UCI and repetitions,

* The repetition bundle in a period is mapped to 1 bit in the bitmap of UTO-UCI.
* UTO-UCI is multiplexed into all repetition in a period at least when UE is configured with startingFromRV0-r16 of “off”.
  + FFS: when UE is configured with startingFromRV0-r16 of “on”.

Moderator’s comment: The proposal seems to be an enhancement (where its necessity is not clear).

* Regarding (1), based on agreement, a bit in bitmap corresponds to a valid CG PUSCH TO. Moderator’s understanding is that assuming that any repetition, if occurs, is considered as a valid CG PUSCH transmission occasion, there would be one bit per repetition rather than one bit per bundle. Hence, the need for change is not clear.
* Regarding (2), it is not clear why this is a special case because for any CG transmission, the gNB does not know when the UE transmits.

### 2.8.1 Initial discussion

**Question:** What is your view about the issue raised above and the corresponding proposal, as well as Moderator’s comment? Do you have a different understanding?

**Question:** What is your view about the issues raised above (Issue#8-1 to Issue#8-6) and the corresponding proposal, as well as Moderator’s comment? Do you have a different understanding?

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# Higher layer parameters topics

The following decision was made during the previous RAN plenary. Therefore, we introduce FG 50-3 to address the related capability associated to this feature.

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| **RP-231820** **PDCCH monitoring resumption after UL NACK**  Proposal 1: RAN to agree to introduce the feature of "PDCCH monitoring resumption after UL NACK" in Rel-18 XR.  - Following TP for TS 38.213 is endorsed.  - A new RRC parameter (e.g., PdcchMornitoringResumptionAfterNack) is introduced.  - An optional UE capability for the feature is introduced.    conclusion: proposal 1 is endorsed |

The following companies provided input regarding the corresponding RRC parameter.

* ZTE, vivo, MediaTek, Qualcomm, Ericsson

**Moderator’s comment**: Moderator suggests discussing the proposal when the offline discussion for XR RRC list for endorsement of higher layer parameters for LS to RAN2, is initiated.

**For the discussion, Moderator suggests using the proposed Excel Sheet by Qualcomm uploaded in draft folder as v000.**

**Please provide comments if any, below.**

## 3.1 Initial discussion

**Question:** Please share your view about the parameter list in v000.

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# Enhancement topics

In this section, the proposals that have been already discussed in previous meetings without any consensus to support, or are not within RAN1 scope are summarized.

## Topic#1: Unit of CG timer of multiple CG occasions in a period

[LG]: LG states that to have multiple transmission occasion in a period, the periodicity of mCG configuration is easy to be larger than other single PUSCH CG configurations. However, the unit of CG timer, which determine how long HARQ processes can be occupied, is same as the length of periodicity. Therefore, when the periodicity of mCG configuration becomes larger, a unit of CG timer and minimum length of CG timer also becomes larger.

Considering the agreement and the previous discussion, the number of transmission occasion in a period could be maximally 32 to cover TDD patterns and to utilize the PUSCH resource, most of HARQ process can be configured to the CG configuration. Then, every single HARQ process configured in the CG configuration should have CG timer of 32 slots in minimum. Which is too large to utilize repeated 32 PUSCH in every period. To solve this problem, CG timer of mCG configuration should use a unit of slot.

Proposal 1: For CG configuration with multiple CG occasions in a period, CG timer is configured with a unit of slots.

**Moderator’s comment:** It seems the issue, if any, is better discussed at RAN2 with proper expertise. Moreover, it is not clear how fundamentally different treatment is needed where single CG configuration can be configured with relatively large periodicity.

## Topic#2: Procedures dependent on cg-UCI-Multiplexing

Sharp has proposed the followings:

**Proposal 1: The *cg-UCI-Multiplexing* parameter is reused to support UTO-UCI and HARQ-ACK joint coding and multiplexing regardless the priorities of the UTO-UCI and HARQ-ACK.**

**Proposal 2: The beta offset for joint coding of UTO-UCI and HARQ-ACK is determined by the HARQ-ACK based on the priorities between the HARQ-ACK and the CG PUSCH.**

**Proposal 3: If *cg-UCI-Multiplexing* is provided, and if the CG PUSCH overlaps with both HP HARQ-ACK and LP HARQ-ACK, only HP HARQ-ACK is jointly coded with UTO-UCI.**

If joint coding of UTO-UCI and HARQ-ACK on CG PUSCH is not supported, at least a dropping rule should be specified.

**Proposal 4: If a PUCCH with a HARQ-ACK overlaps with a CG PUSCH with UTO-UCI and *cg-UCI-Multiplexing* is not provided, one UCI from UTO-UCI and HARQ-ACK is selected and multiplexed on the CG PUSCH considering the UCI priorities.**

* **At least if the HARQ-ACK has the same or a higher priority than the CG PUSCH, the HARQ-ACK is multiplexed on the CG PUSCH, and the UTO-UCI is dropped.**
* **if the HARQ-ACK has lower priority than the CG PUSCH, select one from**
  + **Option 1: priority based dropping, i.e. the LP HARQ-ACK is dropped, UTO-UCI is multiplexed on CG PUSCH.**
  + **Option 2: unified dropping rule, i.e. the LP HARQ-ACK is multiplexed on CG PUSCH, UTO-UCI is dropped.**

**Proposal 5: If a PUCCH with a HARQ-ACK overlaps with a CG PUSCH with UTO-UCI, and *cg-UCI-Multiplexing* is not provided, RAN1 should further study**

* **The UCI dropping rules if both HP HARQ-ACK and LP HARQ-ACK are present.**
* **Whether and how to apply separate coding chains for multiplexing HARQ-ACK(s) and UTO-UCI on CG PUSCH.**

**Moderator’s comment:** It was conclude not to adopt ***cg-UCI-Multiplexing***. It is not clear if the intention is to open the discussion.

## Topic#3: UTO-UCI indication scheme

TCL has proposed the followings:

***Proposal 1: Support a UTO-UCI use to indicate the un-used TOs within a CG period.***

***Proposal 2: For the UTO-UCI to indicate un-used TOs within a CG period, a time offset later than the location where the UTO-UCI sent is needed.***

***Proposal 4: Additional TOs after the end of the configured TO within a CG period and activate more than one CG configurations simultaneously can be considered.***

**Moderator’s comment:** It seems the proposals override the agreement for the UTO-UCI indication that is based on sliding window, and also was concluded not to use offset.

## Topic#4: Collision resolution of CG-PUSCHs

Samsung has proposed the following:

**Proposal 1: Extend the collision resolution procedure for SPS PDSCHs to CG-PUSCHs.**

**Moderator’s comment:** This topic has been brough up last few meetings. There was no consensus for support.

## Topic#5: HARQ retransmission

Inter. Digital and NEC have proposed the following:

***Proposal 1:* Scheduling of retransmissions corresponding to the initial transmissions with multi-PUSCH CG is provided in single DCI**

***Proposal 2:* UE is expected to monitor PDCCH for detecting the DCI for retransmissions with an offset of D slots after transmitting N TBs in N multi-PUSCH CG occasions**

**Moderator’s comment:** This topic has been brough up last few meetings. There was no consensus for support.

## Topic#6: UTO-UCI handling in case of dropping

NEC has the following proposal:

***Proposal 1: if a CG-PUSCH TO which carries an UTO-UCI would overlap in time with a higher priority DG PUSCH or another higher priority CG PUSCH, the UTO-UCI is multiplexed with the DG PUSCH or the another higher priority CG PUSCH.***

***Proposal 2: if two UTO-UCI of two CG configurations with same priority would overlap in time, drop one of the two UTO-UCI based on the CG configuration indices (e.g., drop the UTO-UCI with higher configuration index).***

**Moderator’s comment:** This topic has been brough up last few meetings. There was no consensus for support.

## Topic#7: Timeline for overriding CG PUSCH

NEC has proposed the following:

***Proposal 4: support enhancement on PUSCH preparation time of DG-PUSCH, in case that a high priority DG-PUSCH indicated by a scheduling DCI would overlap in time with a low priority CG-PUSCH occasion, and the low priority CG-PUSCH occasion is indicated as unused before the scheduling DCI.***

**Moderator’s comment:** This topic has been brough up last few meetings. There was no consensus for support.

## 4.1 Initial discussion

**Question:** What is your view about the issues raised above and the corresponding proposal, as well as Moderator’s comment? Do you have a different view?

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# RAN2 LS related topics

Companies have raised the following issues.

**Futurewei:**

**Proposal 2: Keep the RAN1 agreement with incrementing the HARQ process ID of the preceding PUSCH in the period by one for the remaining configured and valid CG PUSCHs.**

**Proposal 3: Send reply LS to RAN2 to convey the final RAN1 agreement with original incrementing rule for HARQ ID determination for the remaining configured and valid CG PUSCHs and it can be captured in RAN1 specification.**

Nokia/NSB:

**Proposal 1**: RAN1 confirms the HARQ process ID determination for multi-PUSCH per CG period that RAN2 sent over LS R1-2308825 (R2-2309007) and that this is captured to chairman’s notes as conclusion.

MediaTek:

**Proposal 2: RAN1 shall inform RAN2 about the relevant L1 specification clause without having further discussions on the definition of “valid CG PUSCH”.**

**Moderator’s comment**: Since a separate discussion is organized for LS response that includes the specification of HARQ process ID in 38.321, Moderator recommends discuss these issues under discussion for RAN2 LS response.

# UE features related topics

The following agreement was made during last meeting to facilitate the UE features discussion.

**Agreement:**

Select one of the following options:

* Option 1: Introduce a new capability to indicated maximum number of multi-PUSCH CG configurations (at least 2) per BWP of a serving cell and across all serving cells
  + FG 50-1 as pre-requisite.
  + FG 11-9 NOT as pre-requisite
* Option 2: Introduce a new capability to indicated maximum number of multi-PUSCH CG configurations (at least 2) per BWP of a serving cell and across all serving cells. The maximum number should not exceed the corresponding maximum number of CG configurations indicated by FG 11-9.
  + FG 50-1 as pre-requisite.
  + FG 11-9 as pre-requisite
* Option 3: Maximum number of multi-PUSCH CG configuration per BWP of a serving cell is one.

Companies views in contributions submitted for AI 8.6.1 are summarized as the following:

* Option 1: CMCC, MTK
* Option 2: vivo, xiaomi, OPPO, CMCC, TCL, Apple, Sony, IDC
* Option 3: Samsung

PDCCH skipping UE feature

* MTK, QC

Open issues related to UE features FG 50-1 and FG 50-2:

* CATT

Xiaomi on defining default value if capability not indicated:

***Proposal 3*: Specify a default value, e.g. 2 or 16, for maximum of consecutive slots in a multi-PUSCH CG configuration if the UE doesn’t indicate the corresponding capability.**

**Moderator’s comment:** From Moderator’s point of view these discussions should take place under UE discussions. Of course, if time allows we can discuss it here.

# 7 Conclusion

TBD

# References

|  |  |  |
| --- | --- | --- |
| [**R1-2308882**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2308882.zip) | Maintenance of CG enhancements for XR capacity | Huawei, HiSilicon |
| [**R1-2308936**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2308936.zip) | Discussion on remaining issues of XR-specific capacity enhancements | FUTUREWEI |
| [**R1-2308992**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2308992.zip) | Remaining issues on XR-specific capacity enhancements | Spreadtrum Communications |
| [**R1-2309081**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2309081.zip) | PDCCH monitoring resumption after NACK | vivo |
| [**R1-2309082**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2309082.zip) | Remaining issue on XR specific capacity enhancements | vivo |
| [**R1-2309180**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2309180.zip) | Discussion on remaining issues of XR | ZTE, Sanechips |
| [**R1-2309273**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2309273.zip) | Remaining issues on XR-specific capacity enhancements | NEC |
| [**R1-2309297**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2309297.zip) | XR-specific capacity enhancements | Nokia, Nokia Shanghai Bell |
| [**R1-2309304**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2309304.zip) | Remaining issues on XR-specific capacity enhancements | LG Electronics |
| [**R1-2309382**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2309382.zip) | Maintenance issues on XR | Samsung |
| [**R1-2309463**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2309463.zip) | Remaining issues on XR-specific capacity enhancements | xiaomi |
| [**R1-2309533**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2309533.zip) | Design of Multiple CG Occasions and unused CG occasion feedback | CATT |
| [**R1-2309620**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2309620.zip) | Discussion on XR specific capacity enhancements | OPPO |
| [**R1-2309678**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2309678.zip) | Maintenance on XR enhancements for NR | CMCC |
| [**R1-2309732**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2309732.zip) | XR specific capacity enhancements | TCL |
| [**R1-2309788**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2309788.zip) | Remaining issues on UTO-UCI and HARQ-ACK collision handling | Sharp |
| [**R1-2309840**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2309840.zip) | Remaining issues in XR-specific capacity enhancements | Apple |
| [**R1-2309908**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2309908.zip) | Remaining Issues on XR capacity enhancements | Sony |
| [**R1-2309939**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2309939.zip) | Remaining issues on XR-specific capacity enhancements | InterDigital, Inc. |
| [**R1-2310002**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2310002.zip) | Remaining issues on XR enhancements | MediaTek Inc. |
| [**R1-2310148**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2310148.zip) | Maintenance on XR Enhancements | Qualcomm Incorporated |
| [**R1-2310255**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_114b/Docs/R1-2310255.zip) | On Maintenance of XR enhancements for NR | Ericsson |

# Appendix

## RAN1#112 agreements and conclusions

### The 1st objective

- Multiple CG PUSCH transmission occasions in a period of a single CG PUSCH configuration (RAN1, RAN2);

**TDRA design:**

**Agreement**

For determination of the time domain resource allocation of CG PUSCHs associated to a **multi-PUSCHs CG**, the following alternatives for further study:

* **Alt-A:** TDRA determination based on repetition framework.
  + **Alt-A1:** Follow the time domain resource mapping of Type A repetition
    - N configured by higher layers or indicated by activation DCI
    - Single SLIV is determined from TDRA
    - The same SLIV in N PUSCH in consecutive slots per CG period
      * FFS for non-consecutive slots
    - FFS details, including related RRC parameters
  + **Alt-A2:** Follow the time domain resource mapping of Type B repetition
    - N configured by higher layers or indicated by activation DCI
    - Single SLIV is determined from TDRA
      * The SLIV used for 1st PUSCH per CG period.
    - N consecutive nominal PUSCHs with same duration per CG period
  + Note: N is not necessarily the repetition factor.

FFS details, including related RRC parameters

* **Alt-B:** TDRA determination based on NR-U framework
  + - N and M configured by higher layers
    - Single SLIV is determined from TDRA.
      * The SLIV used for 1st PUSCH per CG period.
    - M consecutive PUSCH TOs with same duration in slot. The M PUSCH TOs are used in N consecutive slots per CG period
    - Note: N and M are configured independently from *cg-nrofSlots-r16* and *cg-nrofPUSCH-InSlot-r16,* respectively*.* M and N configuration is independent from *cgRetransmissionTimer* configuration.
    - FFS details, including related RRC parameters
* **Alt-C:** TDRA determination based on single DCI scheduling multiple PUSCHs
  + **Alt-C1:** Follow Rel-16 single DCI scheduling multiple PUSCHs
    - TDRA configured by pusch-TimeDomainAllocationListForMultiPUSCH-r16 with k2-r16
    - A row of TDRA with N entries determines the time domain resources allocation of N PUSCH TOs per period
      * Note: N PUSCH TOs should be consecutive PUSCH TOs in consecutive slots.
    - FFS details, including related RRC parameters
  + **Alt-C2:** Follow Rel-17 single DCI scheduling multiple PUSCHs
    - TDRA configured by pusch-TimeDomainAllocationListForMultiPUSCH-r16 with extendedK2-r17
    - A row of TDRA with N entries determines the time domain resources allocation of N PUSCH TOs per period
      * Note: N PUSCH TOs can be non-consecutive PUSCHs and/or in non-consecutive slots.
    - FFS details, including related RRC parameters

**HARQ ID design:**

**Conclusion**

RAN1 discusses to decide how to determine the HARQ process ID of CG PUSCHs of a multi-PUSCHs CG.

**Agreement**

For determination of HARQ process IDs associated to PUSCHs in multi-PUSCHs CG assuming one TB per PUSCH, consider the following alternatives:

* **Alt. 1:** The HARQ process ID for the first configured/valid PUSCH in a period is determined based on the legacy CG procedure when cg-RetransmissionTimer is not configured, and applying "the period duration divided by X instead of the period duration.
  + The HARQ process ID of the remaining PUSCHs in the period is determined by incrementing the HARQ process ID of the preceding PUSCH in the period.
  + Alt 1-1; X = 1
  + Alt 1-2: X is the number of configured PUSCHs in a period
  + Alt 1-3: X is provided by RRC configuration.
  + FFS details
* **Alt. 2:** Support that UE can decide, as in NR-U, the HARQ IDs for the multiple CG PUSCH transmission occasions and indicate the decided HARQ IDs to gNB if multiple HARQ processes are used for the multiple CG PUSCH transmission occasions in a period of a single CG PUSCH configuration
  + FFS details
* **Alt. 3:** The HARQ process ID for the configured PUSCHs in a period is determined based on the legacy CG procedure when cg-RetransmissionTimer is not configured.
  + FFS on potential enhancements different from previous alternatives
  + Alt 3-1: Note: Same HP ID would be used for all PUSCHs within a period.
    - FFS details
  + Alt 3-2: Note: Different HP ID could be used for all PUSCHs within a period.
    - FFS details
* Alt. 4: The HARQ process ID for the first configured/valid PUSCH in a period is determined based on the legacy CG procedure when cg-RetransmissionTimer is not configured.
  + The HARQ process ID of the remaining PUSCHs in the period is determined by incrementing the HARQ process ID of the preceding PUSCH in the period
  + FFS on potential enhancements different from previous alternatives
* Alt 5: Support that UE can decide, as in NR-U, the HARQ IDs for the first CG PUSCH transmission occasions and indicate the decided HARQ IDs to gNB if multiple HARQ processes are used for the multiple CG PUSCH transmission occasions in a period of a single CG PUSCH configuration
  + The HARQ process ID of the remaining PUSCHs in the period is determined by incrementing the HARQ process ID of the preceding PUSCH in the period
  + FFS details
* Alt 6**:** FFS other solutions

**MCS/FDRA, other design parameters:**

**Agreement**

For the PUSCHs parameters in a multi-PUSCHs CG configuration, the configuration/indication parameters except MCS and FDRA of CG PUSCHs in a multi-PUSCHs CG configuration are the same

* FFS: For MCS and FDRA, study further to decide whether/how to be different.
* FFS: Applicability to type-1 and type-2
* Note: TDRA and HP ID are not in this scope of the above statement.

### The 2nd objective:

- Dynamic indication of unused CG PUSCH occasion(s) based on UCI by the UE (RAN1, RAN2);

**What information UTO-UCI contains:**

**Agreement**

For dynamic indication of unused CG PUSCH transmission occasion(s) based on a UCI, the following options for further down-scoping, are considered for the information provided by the UCI:

* **Option 1:** The UCI determines the consecutive CG PUSCH TO(s) that are indicated as “unused”
  + **Option 1-1:** The UCI provides the number of consecutive TO(s) in time domain.
    - Applicable numbers can be determined from information obtained from configuration.
    - FFS details
  + **Option 1-2**: The UCI provides a time duration/range that includes the consecutive TO(s) in time domain.
    - Applicable time duration/range can be determined from information obtained from configuration
    - FFS details
* **Option 2:** The UCI determines the CG PUSCH TO(s) that are indicated as “unused” (consecutive/non-consecutive TO(s) in time domain)
  + **Option 2-1**: The UCI provides a bitmap where a bit corresponds to a TO within a time duration/range. The bit indicates whether the TO is “unused”.
    - Applicable time duration/range can be determined from information obtained from configuration
    - FFS details
  + **Option 2-2:** The UCI provides a bitmap where a bit corresponds to TOs within a time duration/range. The bit indicates whether all TOs within the time duration/range are “unused”.
    - Applicable time duration/range can be determined from information obtained from configuration
    - FFS details
* FFS whether/how the unused TO(s) can be associated to multiple CG configuration.
* Other options are not precluded. Proponent companies to provide details.

**When UTO-UCI is sent:**

**Agreement**

For dynamic indication of unused CG PUSCH occasion(s) based on a UCI, the following options for further down-scoping with possible revision, are considered for the transmission occasion of the UCI:

* **Option 1:** A transmitted CG PUSCH, includes the UCI.
  + FFS details
* **Option 2:** A transmitted CG PUSCH includes the UCI, if it is transmitted in an occasion determined by RRC.
  + FFS details
* **Option 3:** A transmitted CG PUSCH includes the UCI, if it is transmitted in a pre-defined transmission occasion.
  + FFS details
    - Example of a pre-determined occasion: 1st configured PUSCH TO in a CG period or 1st configured PUSCH TO in a multiple CG periods
* **Option 4:** A transmitted CG PUSCH includes the UCI, if it is transmitted in a transmission occasion determined satisfying given condition(s).
  + FFS details
    - Examples of a condition: A first transmitted PUSCH in a CG period, or a first PUSCH transmission within a multiple of CG periods.

Other options are not precluded. Proponent companies to provide details.

**How UTO-UCI is sent:**

**Agreement**

The physical channel that carries the UCI that provides information about unused CG PUSCH transmission occasions is CG PUSCH.

**Agreement**

Encoding and multiplexing for “the UCI that provides information about unused CG PUSCH transmission occasions” in a CG PUSCH applies encoding and multiplexing procedures for CG-UCI as baseline.

* FFS on details

**Agreement**

Consider the following alternatives for “the UCI that provides information about unused CG PUSCH transmission occasions” for down-selection or revision

* Alt. 1: “The UCI that provides information about unused CG PUSCH transmission occasions” is defined as a new UCI.
  + FFS on details
* Alt. 2: “The UCI that provides information about unused CG PUSCH transmission occasions” is added as new field(s) to the CG-UCI.
  + FFS on details
* Alt. 3: “The UCI that provides information about unused CG PUSCH transmission occasions” replaces/re-purposes some field(s) of the CG-UCI.
  + FFS on details

## RAN1#112bis-e agreements and conclusions

### The 1st objective

- Multiple CG PUSCH transmission occasions in a period of a single CG PUSCH configuration (RAN1, RAN2);

**TDRA design:**

**Agreement:**

For TDRA design for multi-CG PUSCH, prioritize Alt-A1, Alt-B, and Alt-C2 for further downscoping and/or modification from corresponding agreement in RAN1#112.

* FFS: How to address TDD configuration issue

**MCS design:**

**Agreement:**

For CG PUSCHs in a multi-PUSCHs CG configuration, MCS of the CG PUSCHs in the CG configuration are the same between different PUSCH occasions

**FDRA design:**

**Agreement:**

For CG PUSCHs in a multi-PUSCHs CG configuration, FDRA of the CG PUSCHs in the CG configuration are the same between different PUSCH occasions

**HARQ ID design:**

**Agreement:**

From RAN1 perspective, for determination of HARQ process Ids associated to PUSCHs in multi-PUSCHs CG assuming one TB per PUSCH:

* The HARQ process ID for the first configured/valid PUSCH in a period is determined based on the legacy CG procedure when cg-RetransmissionTimer is not configured, and applying the following formula, whichever is applicable
  + HARQ Process ID = [floor(X\*(CURRENT\_symbol – offset1) / *periodicity*) + offset2] modulo *nrofHARQ-Processes*
  + HARQ Process ID = [floor(X\*(CURRENT\_symbol – offset1) / *periodicity*) + offset2] modulo *nrofHARQ-Processes* + *harq-ProcID-Offset2*
    - FFS whether in formulas above X is outside or inside floor operation, i.e.
      * HARQ Process ID = [X\*floor( (CURRENT\_symbol – offset1) / *periodicity*) + offset2] modulo *nrofHARQ-Processes*
      * HARQ Process ID = [X\*floor((CURRENT\_symbol – offset1) / *periodicity*) + offset2] modulo *nrofHARQ-Processes* + *harq-ProcID-Offset2*
  + (Working Assumption) The HARQ process ID of the remaining configured/valid CG PUSCHs in the period is determined by incrementing the HARQ process ID of the preceding PUSCH in the period by Y with module operation with *nrofHARQ-Processes* or module operation with (*nrofHARQ-Processes* + *harq-ProcID-Offset2*), whichever applicable.
    - FFS whether X=1 or X= the number of configured PUSCHs in the CG period
    - FFS whether Y =1 or a value larger than 1, e.g. Y=2.
      * FFS: If Y>1, Y is determined based on RRC
    - FFS whether Offset 1= 0 or can be a non-zero value.
      * FFS: If offset1 is non-zero, how offset1 is determined (i.e., based on RRC)
    - FFS whether Offset 2= 0 or can be a non-zero value.
      * FFS: If offset2 is non-zero, how offset2 is determined (i.e., based on RRC or dynamically)
* Note1: The equations will be updated accordingly when FFSs are clarified, e.g., if X=1, remove X; if Y=1, remove Y; if non-zero offset1 or Offset 2 is not supported, remove offset 1 or Offset 2.
* Note2: A configured CG PUSCH is invalid if the CG PUSCH is dropped due to collision with DL symbol(s) indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated or SSB*.

### The 2nd objective:

- Dynamic indication of unused CG PUSCH occasion(s) based on UCI by the UE (RAN1, RAN2);

**What information UTO-UCI contains:**

**Agreement**

For dynamic indication of unused CG PUSCH transmission occasion(s) based on a UCI, the indicated “unused” CG PUSCH TO(s), if any, by the UCI in a CG PUSCH for a CG configuration

* can be consecutive or non-consecutive CG PUSCH TO(s) in time domain [in one CG period]
* FFS whether/how the unused TO(s) can be associated to multiple CG configuration.

Note: FFSs and further details in corresponding agreement in RAN1#112 for the selected option are remained for further discussion

Note: Above corresponds to Option 2 (w.r.t. agreement in RAN1#112)

**Agreement**

The UTO-UCI provides a bitmap where a bit corresponds to a TO within a time duration/range. The bit indicates whether the TO is “unused”.

* FFS: Details including time duration/range

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

**When UTO-UCI is sent:**

**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.

**How UTO-UCI is sent:**

**Agreement**

The UCI that provides information about unused CG PUSCH transmission occasions is defined as a “new UCI” (i.e. Alt. 1 of previous agreement).

**Agreement**

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

**Agreement**

The existing CG-UCI encoding and multiplexing procedures are reused for encoding the “UTO-UCI” in a configured grant PUSCH in absence or presence of other UCIs being multiplexed in the PUSCH, by applying the following adjustments:

* The “UTO-UCI” is used instead of CG-UCI in the corresponding procedures for encoding of CG-UCI and/or HARQ-ACK, whichever is present.
* For determining the beta-offset,
  + Beta offset is configured for the “UTO-UCI”
    - If UTO-UCI and HARQ-ACK is not jointly encoded, the beta offset for the “UTO-UCI” is used in the procedures instead of CG-UCI beta offset
    - If UTO-UCI and HARQ-ACK is jointly encoded, HARQ-ACK beta offset is used in the procedures instead of CG-UCI beta offset
* FFS on sequence generation order between UTO-UCI and HARQ-ACK
* FFS on dropping rule between UTO-UCI and HARQ-ACK when joint encoding is not configured
* Note: The term “UTO-UCI” refers to the “UCI that provides information about unused CG PUSCH transmission occasions” for convenience.

## RAN1#113 agreements and conclusions

### The 1st objective

Multiple CG PUSCH transmission occasions in a period of a single CG PUSCH configuration (RAN1, RAN2);

**TDRA design:**

Working Assumption

For time domain resource allocation for multi-PUSCH CGs, support

* For TDRA determination (based on NR-U framework)
  + For Type-1, follow the rules for DCI format 0\_0 on UE specific search space, as defined in Clause 6.1.2.1.1 of TS 38.214.
    - Note: To determine the configuration of TDRA, PUSCH repetition type A is assumed according to description in 6.1.2.3 in 38.214 for Type-1.
      * It is still an open issue whether repetition is supported. If it is decided repetition is not supported, it implies the corresponding repetition factor for is one.
  + For Type-2, the TDRA table is determined by the TDRA table associated with activation DCI, as defined in Clause 6.1.2.1 of TS 38.214.
    - Note: The DCI format for activation DCI with pusch-RepTypeA is applicable.
      * It is still an open issue whether repetition is supported. If it is decided repetition is not supported, it implies the corresponding repetition factor for is one.
* N is configured by higher layers
* A single SLIV is determined from TDRA.
  + The SLIV used for 1st PUSCH per CG period.
* The PUSCH is used in each of N consecutive slots per CG period
* Note: N is configured independently from *cg-nrofSlots-r16* and *cg-nrofPUSCH-InSlot-r16,* respectively*.* N configuration is independent from *cgRetransmissionTimer* configuration.
* To determine corresponding slots for CG PUSCHs in a period of a multi-PUSCH CG configuration:
  + For the first PUSCH in the period, follow the legacy procedures.
  + For remaining PUSCHs in the period
    - ForType-1 and Type-2, reuse the corresponding procedures for NR-U by applying the RRC parameters N, instead of *cg-nrofSlots-r16* and *cg-nrofPUSCH-InSlot-r16*, respectively.
* FFS: Whether/How to further enhance for operation on TDD

**Agreement**

For time domain resource allocation for multi-PUSCH CGs, support

* For TDRA determination (based on NR-U framework)
  + For Type-1, follow the rules for DCI format 0\_0 on UE specific search space, as defined in Clause 6.1.2.1.1 of TS 38.214.
    - Note: To determine the configuration of TDRA, PUSCH repetition type A is assumed according to description in 6.1.2.3 in 38.214 for Type-1.
      * It is still an open issue whether repetition is supported. If it is decided repetition is not supported, it implies the corresponding repetition factor for is one.
  + For Type-2, the TDRA table is determined by the TDRA table associated with activation DCI, as defined in Clause 6.1.2.1 of TS 38.214.
    - Note: The DCI format for activation DCI with pusch-RepTypeA is applicable.
      * It is still an open issue whether repetition is supported. If it is decided repetition is not supported, it implies the corresponding repetition factor for is one.
* N is configured by higher layers
* A single SLIV is determined from TDRA.
  + The SLIV used for 1st PUSCH per CG period.
* The PUSCH is used in each of N consecutive slots per CG period
* Note: N is configured independently from *cg-nrofSlots-r16* and *cg-nrofPUSCH-InSlot-r16,* respectively*.* N configuration is independent from *cgRetransmissionTimer* configuration.
* To determine corresponding slots for CG PUSCHs in a period of a multi-PUSCH CG configuration:
  + For the first PUSCH in the period, follow the legacy procedures.
  + For remaining PUSCHs in the period
    - ForType-1 and Type-2, reuse the corresponding procedures for NR-U by applying the RRC parameters N, instead of *cg-nrofSlots-r16* and *cg-nrofPUSCH-InSlot-r16*, respectively.

**HARQ ID design:**

**Agreement:**

With respect to the agreement on HARQ process ID determination for multi-PUSCH Cg in RAN1#112bis-e, support the following:

* Y=1
* Offset 1=0 (i.e., remove Offset 1)
* Offset 2=0 (i.e., remove Offset 2)

**Agreement**

For determination of HARQ process Ids associated to PUSCHs in multi-PUSCHs CG assuming one TB per PUSCH:

* X is outside the floor operation
* X= the number of configured PUSCHs in the CG period

Send an LS to RAN2 to inform this agreement. LS is endorsed in R1-230XXXX.

**Agreement**

The following working assumption is confirmed

(Working Assumption) The HARQ process ID of the remaining configured/valid CG PUSCHs in the period is determined by incrementing the HARQ process ID of the preceding PUSCH in the period by one with module operation with *nrofHARQ-Processes* or module operation with (*nrofHARQ-Processes* + *harq-ProcID-Offset2*), whichever applicable.

**Agreement**

From RAN1 perspective, for determination of HARQ process IDs associated to PUSCHs in multi-PUSCHs CG assuming one TB per PUSCH:

* The HARQ process ID for the first configured PUSCH in a period is determined based on the legacy CG procedure when cg-RetransmissionTimer is not configured, and applying the following formula, whichever is applicable
  + HARQ Process ID = [X\*floor( (CURRENT\_symbol ) / *periodicity*)] modulo *nrofHARQ-Processes*
  + HARQ Process ID = [X\*floor((CURRENT\_symbol ) / *periodicity*)] modulo *nrofHARQ-Processes* + *harq-ProcID-Offset2*
    - X= the number of configured PUSCHs in the CG period
* The HARQ process ID of the remaining configured and valid CG PUSCHs in the period is determined by incrementing the HARQ process ID of the preceding PUSCH in the period by one with module operation with *nrofHARQ-Processes* or module operation with (*nrofHARQ-Processes* + *harq-ProcID-Offset2*), whichever applicable.
* Note: A configured CG PUSCH is invalid if the CG PUSCH is dropped due to collision with DL symbol(s) indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated or SSB*.

Send an LS to RAN2 to convey the above RAN1 agreement. Final LS is in R1-2306233.

### The 2nd objective:

Dynamic indication of unused CG PUSCH occasion(s) based on UCI by the UE (RAN1, RAN2);

**General**

**Agreement**

* When a CG PUSCH occasion is indicated as “unused”, the UE is not allowed to transmit CG PUSCH on that CG PUSCH occasion.
* For any other CG PUSCH occasion that is NOT indicated as “unused”, the UE is allowed to transmit or not to transmit CG PUSCH on that CG PUSCH occasion as per legacy specification.
  + No RAN1 specification impact

**Agreement**

* A CG PUSCH occasion indicated as “unused” earlier, is not allowed to be indicated as “NOT unused later”.
* A CG PUSCH occasion indicated as “NOT unused” earlier, can be indicated as “unused” later.
  + FFS: Whether there is specification impact

**Agreement:**

The UTO-UCI indication for a CG configuration is applicable to only valid CG PUSCH TOs, if any.

* Note: A configured CG PUSCH is invalid if the CG PUSCH is dropped due to collision with DL symbol(s) indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated or SSB*. Otherwise, it is valid.

Agreement

Indication of UTO-UCI by CG PUSCHs associated to a CG configuration, is enabled by configuration of an RRC parameter.

* FFS on whether/how to extend to multiple CG configurations

**What information UTO-UCI contains:**

**Agreement:**

For a CG configuration with UTO-UCI indication enabled, to determine the indicated CG PUSCH by a UTO-UCI indication, consider the following options for further down-selection:

**Option A-1a:**

* + Configure the RRC parameter UTO\_period.
    - FFS range value of UTO\_period
      * Alt-1: values in time unit (e.g., XR traffic periodicity)
      * Alt-2: one or multiple of CG periodicity given by integer values (n=1, 2, ..)
  + The starting time of the first period of UTO periodicity starts at the same as starting time of the first period of the CG configuration and ends after UTO\_period. The next UTO period(s) are followed after the first UTO period.
  + A transmitted CG PUSCH that is confined within a UTO period, carries UTO-UCI that is applicable to the CG PUSCH TOs within the UTO period.

**Option A-2a:**

* + Configure the RRC parameter UTO\_period.
    - FFS range value of UTO\_period
      * Alt-1: values in time unit (e.g., XR traffic periodicity)
      * Alt -2: one or multiple of CG periodicity given by integer values (n=1, 2, ..)
* Configure the RRC parameter UTO\_offset.
  + FFS range value of UTO\_offset
* The starting time of the first period of UTO periodicity starts at the same as starting time of the first period of the CG configuration and ends after UTO\_period. The next UTO period(s) are followed after the first UTO period.
* A transmitted CG PUSCH that is confined within a UTO period, carries UTO-UCI that is applicable to the CG PUSCH TOs within the UTO period and after UTO\_offset from the end of the transmitted CG PUSCH.

**Option B-a:**

* Configure the RRC parameter UTO\_period.
  + FFS range value of UTO\_period
    - Alt-1: values in time unit (e.g., XR traffic periodicity)
    - Alt -2: one or multiple of CG periodicity given by integer value (n=1, 2, ..)
* 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 valid CG PUSCH TOs that are confined within UTO\_period starting with UTO\_offset from the end of the transmitted CG PUSCH.

**Option B-b2:**

* 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.

FFS on whether/how to extend to multiple CG configurations

## RAN1#114 agreements and conclusions

### The 1st objective

Multiple CG PUSCH transmission occasions in a period of a single CG PUSCH configuration (RAN1, RAN2);

**Conclusion**

For Type-1 and Type-2 multi-PUSCH CG configuration, Type-A repetition is NOT supported in Rel-18

**Agreement**

For a multi-PUSCH CG configuration, the range value of the higher layer parameter indicating number of consecutive slots (N in previous agreements) is:

* Max value=16 or 32
  + Up to UE capability
* Min value=2

**Agreement:**

Select one of the following options:

* Option 1: Introduce a new capability to indicated maximum number of multi-PUSCH CG configurations (at least 2) per BWP of a serving cell and across all serving cells
  + FG 50-1 as pre-requisite.
  + FG 11-9 NOT as pre-requisite
* Option 2: Introduce a new capability to indicated maximum number of multi-PUSCH CG configurations (at least 2) per BWP of a serving cell and across all serving cells. The maximum number should not exceed the corresponding maximum number of CG configurations indicated by FG 11-9.
  + FG 50-1 as pre-requisite.
  + FG 11-9 as pre-requisite
* Option 3: Maximum number of multi-PUSCH CG configuration per BWP of a serving cell is one.

### The 2nd objective:

Dynamic indication of unused CG PUSCH occasion(s) based on UCI by the UE (RAN1, RAN2);

**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.

FFS on whether/how to extend to multiple CG configurations

Strong concerns have been raised on the above proposal in terms of benefit and UE complexity by CATT, ZTE, Huawei, Apple, MTK, and Google.

**Agreement**

When UTO-UCI and HARQ-ACK are jointly encoded, HARQ-ACK bit sequence is concatenated after UTO-UCI bit sequence, by reusing the same mechanism adopted for joint encoding of CG-UCI and HARQ-ACK.

**Conclusion**

There is no consensus on the following proposal:

Introduce a new RRC parameter UTO-UCI-Multiplexing (similar to cg-UCI-Multiplexing) to enable/disable joint coding of HARQ-ACK and UTO-UCI in a CG PUSCH with the UTO-UCI.

**Agreement**

For a CG configuration with UTO-UCI indication enabled:

* For the range value for the RRC parameter Nu (Nu is the size of bit-map): (3, …, 8)

**Conclusion**

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

**Conclusion**

Extending the UTO\_UCI indication by CG PUSCH(s) of a CG configuration to CG PUSCH(s) of other CG configuration(s) is not supported in Rel-18.

### General

**Agreement**

Response LS to [R1-2306379](file:///C:\Users\younsun\Documents\3GPP%20documents\RAN1%20tdocs\TSGR1_114\Docs\R1-2306379.zip) is agreed. LS in [R1-2308654](file:///C:\Users\younsun\Documents\3GPP%20documents\RAN1%20tdocs\TSGR1_114\Docs\R1-2308654.zip).

**Agreement**

The following TP with stage 2 description for physical layer enhancements is endorsed in principle for TS 38.300. Send an LS to RAN2. Final LS in [R1-2308659](file:///C:\Users\younsun\Documents\3GPP%20documents\RAN1%20tdocs\TSGR1_114\Docs\R1-2308659.zip).

**-----------------< Start of TP>--------------------**

**16.X.4    Capacity**

**16.X.4.1        Physical Layer Enhancements**

The following enhancements for configured grant-based PUSCH transmission are introduced:

-     Support of multiple CG PUSCH transmission occasions within a single period of a CG configuration

-     Indication of unused CG PUSCH occasion(s) of a CG configuration with Uplink Control Information multiplexed in CG PUSCH transmission of the CG configuration.

**-----------------< End of TP>--------------------**

### RAN#101 agreements

|  |
| --- |
| **RP-231820** **PDCCH monitoring resumption after UL NACK**  Proposal 1: RAN to agree to introduce the feature of "PDCCH monitoring resumption after UL NACK" in Rel-18 XR.  - Following TP for TS 38.213 is endorsed.  - A new RRC parameter (e.g., PdcchMornitoringResumptionAfterNack) is introduced.  - An optional UE capability for the feature is introduced.    conclusion: proposal 1 is endorsed |