3GPP TSG-RAN WG1 Meeting #115 R1-23xxxxx

Chicago, USA, November 13th -17th, 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 RAN1#114 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#115 under Agenda item 8.6. It is also intended to facilitate the discussions regarding the topics with respect to the following assignment by the RAN1 Chair:

[115-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

## 2.1 Issue#1: CG release/activation on applicability of UTO-UCI

Moderator’s summary:

See Table 1.

During the last meeting, an issue was raised regarding the status of already indicated CG PUSCH TOs by UTO-UCI with respect to de-activation/release and initialization/re-initialization.

Companies’ views are summarized below:

* No need for additional specification
	+ FW, IDC, Apple, Samsung, Ericsson, QC, Nokia (with clarification TP)
* Need for additional specification.
	+ Xiaomi, LG

Moderator observation: It seems fundamentally there is no disagreement between companies. All seems to share the same view (please review the proposals and motivations provided by companies below) 😊 The only difference is whether the behaviour should be specified.

Three companies proposed TP for this purpose (Nokia, LG and Xiaomi). From Moderator’s perspective, LG’s TP is the most complete and fits description in 38.213. As this topic, has caused some discussion, it is perhaps helpful to adopt the TP proposed by LG.

Moderator’s recommendation: Based on the observation above, Moderator recommends adopting LG’s TP.

Table 1: Companies’ views and proposals

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| FW**Observation 1: UTO-UCI is just used by UE to indicate the status (e.g., used, or unused) of PUSCH occasions of the CG to gNB. Whether/how to reallocate/reschedule the unused PUSCH occasions (or even the used PUSCH occasions) is completely up to gNB implementation.****Proposal 2: A TP for impacts of CG release/activation on applicability of UTO-UCI is not needed.** |
| IDCBased on the discussion during RAN1#114bis [1], it is clear that the UTO-UCI indication is valid only for the activated CG configuration, and there is no need to assume any new consequences regarding a previously transmitted UTO-UCI when the CG configuration is re-activated (upon deactivation) or released. The UE can assume the TOs become invalid regardless of whether they were previously indicated in UTO-UCI as used or unused upon deactivation or release of the CG configuration. As such, the TP is not necessary. ***Proposal 2:* Do not adopt the proposed TP on UTO-UCI indication and CG release/deactivation under Clause 9.3.1 in TS 38.213.**  |
| AppleAt RAN1 #114bis, one discussion was to handle the UTO signaling during transit period:1. A CG configuration (CG-1) is deactivated;
2. A CG configuration (CG-2) is re-activated (NW sends an activation DCI with the same *configuredGrantConfigIndex as CG-1 which was previously activated)*

In both cases, since the CG PUSCH transmissions associated with CG-1 are not applicable anymore, the UE should be allowed to transmit a CG PUSCH associated with another CG configuration. No special handling is needed for that in Rel-18. We have:**Proposal 1: no special handling is introduced to handle CG configuration’s deactivation or reactivation.** |
| SamsungFor release of CG-PUSCH transmissions for a CG configuration, based on existing specifications, the UE subsequently transmits a CG-PUSCH that includes a MAC-CE that confirms the release and subsequently all resources are released. There is no ambiguity for the overall operation or for the applicability of UTO-UCI which becomes null after the UE releases the resources for the (deactivated) CG configuration. Used TOs are released (known to both UE and gNB) and unused TOs are treated as usual (including for scheduling the UE itself). For re-activation of CG-PUSCH transmissions for a CG configuration, as the resources were previously released, UTO-UCI prior to the release (and prior to the re-activation) is evidently not applicable. In general, there is no impact from the existence of UTO-UCI on legacy procedures.**Observation 3:** *Existence of UTO-UCI does not affect legacy use by a UE of resources for a CG configuration after release or after re-activation of respective CG-PUSCH transmissions.* |
| EricssonIn our view, the indication of UTO-UCI is associated to the ongoing configured grant. If the UE receives release/deactivation/re-initialization, based on these actions the ongoing configured grant would be abandoned and a new one in case of deactivation/re-initialization would be effective. Therefore, the previously indicated UTO-UCI for any transmission occasion is only meaningful in the context of the configured grant that is associated with, and it is not reasonable to assume the information by the indicated UTO-UCI can be assumed to be applicable to the new configured grant. Hence, it is not clear if any clarification is needed.1. There is no need for specification of the status of indicated UTO-UCI for a configured grant after release/deactivation/re-initialization.
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| QualcommThe UE may receive a re-activation DCI for a Type-2 CG configuration that can reduce MCS, time domain or frequency domain resource allocation for the CG configuration. Then the UE may not have sufficient UL resources in future “not unused” CG PUSCH TOs to transmit the remaining UL data. The UE needs to switch some “unused” CG PUSCH TOs in the future to “not unused”. However, Rel-18 has concluded that a CG PUSCH TO indicated as “unused” cannot be switched to “not unused” later. This issue was brought up by [5] and was discussed in RAN1 #114bis without conclusion [2]. We notice a similar issue exists when a future CG PUSCH TO indicated as “not unused” is cancelled by SFI, UL cancellation indication in DCI format 2\_4 or a PDSCH or PUSCH scheduled by dynamic grant. ***Observation 1: There are cases that a DCI causes UL resources to become insufficient in future “not unused” CG PUSCH TOs for transmitting the remaining UL data in the CG period.**** ***Re-activation DCI grants lower MCS or less time and frequency resources in each CG PUSCH TO***
* ***“Not unused” CG PUSCH TO is cancelled by SFI, UL cancellation indication in DCI format 2\_4 or a PDSCH or PUSCH scheduled by dynamic grant.***

To fully benefit from the Rel-18 CG enhancements, the UE should be allowed to switch one or multiple future CG PUSCH TOs that have been indicated as “unused” to “not unused” so that the UE still has enough resources to transmit the remaining UL data in the CG period. However, this requires dedicated discussion that is more suitable in Rel-19 rather than in Rel-18 as maintenance.***Proposal 2: Solution to the insufficient UL resource issue caused by a DCI including CG re-activation DCI, SFI, UL cancellation indication or UL/DL dynamic grant can be discussed in Rel-19 as further UTO-UCI optimization for XR capacity enhancements.*** |
| NokiaAnother issue raised during RAN1#114bis was the case related to UTO-UCI and CG deactivation. Particularly, when the indication of UTO-UCI is no longer valid: after gNB sends the deactivation command or after it received the confirmation for deactivation from UE. We think this indeed an ambiguous case and shall be resolved. Next, we describe one particular scenario related to CG deactivation and compare different possible solutions. The very first TO when UE may send confirmation is “unused”: * **Approach 1: Indication in UTO-UCI is no longer valid after gNB sends the deactivation command**. In that approach, the indication of “unused” is no longer valid after gNB sends the deactivation command, UE do not need to wait for the next TO. However, we already have an agreement that changing from unused to used is not possible. Moreover, gNB might have already re-used the resources, thus this may cause some issues.
* **Approach 2: Indication in UTO-UCI is no longer valid after UE sends the confirmation and gNB receives the confirmation.** In that approach, the indication of “unused” is still valid after gNB sends the deactivation command and before it receives the confirmation from UE, UE needs to wait for the next TO that is available. Or, more likely, gNB will schedule the UE to send the confirmation with dynamic grant.

Based on the comparison above, we think that Approach 2 is the most convenient one, the indication from UTO-UCI is no longer valid when all CG resources are released, thus after gNB received the confirmation. Thus, no extra optimization is needed.***Proposal 4:*** *Confirm that indication in UTO-UCI is no longer applicable when the CG resources are released, thus when gNB receives the confirmation for CG deactivation.*One possible way to capture the clarification is updating TS 38.213 (9.3.1). Another alternative is to capture the clarification in TS 38.321 where more details about CG deactivation are provided.***Proposal 5:*** *Decide if clarification related to applicability of UTO-UCI indication is needed in TS 38.213 or in TS 38.321. If decided to include it to TS 38.213 consider the following TP for TS 38.213 (9.3.1).*

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| 9.3.1 UE procedure for reporting UTO-UCIIf the UE is provided *nrof\_UTO\_UCI* with value equal to $O^{UTO-UCI}$ in *configuredGrantConfig* of a CG-PUSCH configuration, the UE multiplexes UTO-UCI represented by a bitmap of $O^{UTO-UCI}$ bits in each CG-PUSCH transmission for the CG-PUSCH configuration. The $O^{UTO-UCI}$ bits of UTO-UCI, $\tilde{o}\_{0}^{UTO-UCI}, \tilde{o}\_{1}^{UTO-UCI}, …, \tilde{o}\_{O^{UTO-UCI}-1}^{UTO-UCI}$, have a one-to-one mapping to $O^{UTO-UCI}$ subsequent CG-PUSCH TOs in ascending order of start time. For unpaired spectrum operation, the $O^{UTO-UCI}$ subsequent CG-PUSCH TOs exclude invalid ones where a UE does not transmit a PUSCH due to collision of the PUSCH with DL symbol(s) indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, or with symbol(s) of an SS/PBCH block with index provided by *ssb-PositionsInBurst*, based on the procedures in Clause 11.1. A bit value of ‘0’ indicates that the UE may transmit CG-PUSCH, and a bit value of ‘1’ indicates that the UE will not transmit CG-PUSCH, in a corresponding CG-PUSCH TO. When the UE indicates by UTO-UCI a value of ‘1’ for a CG-PUSCH TO, the UE continues to indicate the value of ‘1’ for the CG-PUSCH TO by UTO-UCI multiplexed in subsequent CG-PUSCH transmissions, and the UE does not transmit CG-PUSCH in the CG-PUSCH TO. The indication provided by UTO-UCI is applicable until the configured uplink grant deactivation. |

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| Xiaomi**Observation 4**: CG de-activation/release has no effect on the behaviour of both UE and gNB if the UE didn't miss the releasing DCI.**Observation 5**: gNB needs to be restricted from assuming that UTO-UCI is always valid until it receives a confirmation MAC CE from UE for avoiding potential ambiguity because of DCI missing.**Proposal 3**: Proposed TP for Clause 9.3.1 of 38.213:For a Type-2 CG-PUSCH configuration an indicated UTO-UCI bit in a CG-PUSCH transmission is appicable unless the gNB receives Configured Grant Confirmation MAC CE or Multiple Entry Configured Grant Confirmation MAC CE MAC CE from the UE. |
| LGThere are two representative cases that change upcoming CG PUSCH occasions. One is re-initialization via activation DCI and the other is deactivation via release DCI. For re-initialization, it is ambiguous whether CG PUSCHs can be distinguished according to whether those are activated by different activation DCI, since the current description only consider whether it is same configuration or not. For example, if an activation DCI indicates to only change MCS and UE re-initializes CG PUSCHs via the activation DCI, re-initialized CG PUSCHs could be interpreted as “subsequent CG-PUSCH” by the description. It seems necessary to clarify whether the old UTO-UCI is applicable.텍스트, 폰트, 스크린샷, 화이트이(가) 표시된 사진  자동 생성된 설명Figure 1.Also, when CG PUSCH are re-initialized, confirmation MAC-CE is triggered in MAC layer at the UE and need to be transmitted to inform the gNB of successful activation of CG configuration. The firstly activated CG PUSCH typically conveys the confirmation MAC-CE to gNB. If the old UTO-UCI is still applicable, as shown in Figure 1 where first 3 re-activated PUSCHs cannot be used, UE may not able to transmit the confirmation immediately due to UTO-UCI, unless gNB schedules additional PUSCH resource to the UE. Once UE receives release DCI from gNB, UE releases the resource immediately after first transmission of Configured Grant Confirmation MAC-CE, rather than just after the reception of release DCI. Thus, the CG resources remains active until the MAC-CE transmission even if UE receives release DCI. If UTO-UCI is applicable even after the reception of release DCI, UE may need another UL grant to transmit CG confirmation MAC-CE to release CG, especially when the upcoming CG PUSCHs are indicated as unused. It may impose gNB burden to schedule redundant UL grant just to receive confirmation MAC-CE.텍스트, 폰트, 라인, 영수증이(가) 표시된 사진  자동 생성된 설명 Figure 2.For both cases, it is beneficial that gNB and UE ignore the old UTO-UCI and treat it as invalid. In other words, gNB assumes there is no “unused” PUSCH occasions on the CG configuration and UE should be able to generate TB and be allowed to re-indicate upcoming PUSCH occasions as “not unused” regardless of whether the PUSCH occasions was indicated as “unused” previously. Proposal 3: Once CG PUSCH is re-activated (or released), the UTO-UCI previously transmitted before the re-activation (or release), is invalid for the CG PUSCH(s) newly activated.Proposal 4: When CG PUSCH is re-activated (or released), it is allowed for UE to re-indicate a PUSCH occasion as “not unused” even if the PUSCH occasion was indicated as “unused” before the re-activation (or release).Proposal 5: Adopt following TP for Clause 9.3.1 of 38.213:

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| ***Reason for change:*** |  UTO-UCI is indicating the usage of upcoming ‘subsequent CG-PUSCH TOs’ for the same CG configuration. However, the upcoming CG PUSCH occasions could be changed by activation/release DCI or RRC re-configuration. If there are some changes on upcoming CG PUSCH occasion via DCI, it is ambiguous whether the previous UTO-UCI can be applied to upcoming CG PUSCH occasions after the reception of activation/release DCI.  |
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| ***Summary of change:*** | Clarify that the previously transmitted UTO-UCI is not applicable to CG PUSCH occasions after the reception of activation/release DCI for the same configurration. |
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| ***Consequences if not approved:*** | UE behavior remains ambiguous for the case when UE receives activation/release DCI for the CG PUSCH occasions where previously indicated as “unused”.  |
| 9.3.1 UE procedure for reporting UTO-UCIIf the UE is provided *nrof\_UTO\_UCI* with value equal to $O^{UTO-UCI}$ in *configuredGrantConfig* of a CG-PUSCH configuration, the UE multiplexes UTO-UCI represented by a bitmap of $O^{UTO-UCI}$ bits in each CG-PUSCH transmission for the CG-PUSCH configuration. The $O^{UTO-UCI}$ bits of UTO-UCI, $\tilde{o}\_{0}^{UTO-UCI}, \tilde{o}\_{1}^{UTO-UCI}, …, \tilde{o}\_{O^{UTO-UCI}-1}^{UTO-UCI}$, have a one-to-one mapping to $O^{UTO-UCI}$ subsequent CG-PUSCH TOs in ascending order of start time. For unpaired spectrum operation, the $O^{UTO-UCI}$ subsequent CG-PUSCH TOs exclude invalid ones where a UE does not transmit a PUSCH based on the procedures in Clause 11.1. A bit value of ‘0’ indicates that the UE may transmit CG-PUSCH, and a bit value of ‘1’ indicates that the UE will not transmit CG-PUSCH, in a corresponding CG-PUSCH TO. When the UE indicates by UTO-UCI a value of ‘1’ for a CG-PUSCH TO, the UE continues to indicate the value of ‘1’ for the CG-PUSCH TO by UTO-UCI multiplexed in subsequent CG-PUSCH transmissions, and the UE does not transmit CG-PUSCH in the CG-PUSCH TO. For a Type-2 CG-PUSCH configuration, an indicated UTO-UCI bit in a CG-PUSCH transmission is applicable for the corresponding CG PUSCH TO only when it occurs before the UE receives a DCI format that indicates an activation/release for the same Type-2 CG-PUSCH configuration. |

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### 2.1.1 Initial discussion

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

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| Company | Comment |
| DOCOMO | Actually we don’t think there would be ambiguity on UE behavior without modification. But we are fine with moderator’s suggestion to adopt LGE’s TP. |
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## 2.2 Issue#2: Lack of support for repetition and TBoMs for Multi-PUSCH

Moderator’s summary:

See Table 2’.

Repetition is not supported for multi-PUSCH. One company proposed last time that in case, repetition is obtained from TDRA, UE ignores repetition factor (i.e. assumes =1).

All companies except, do not see the need, which means the repetition factor should be configured with 1 if supported.

* Alt 1) Repetition is not supported == repetition factor if provided should be 1.
	+ Vivo, Xiaomi, IDC, DCM, Apple, Nokia, Samsung, LG, OPPO
* Alt 2) Repetition is not supported == repetition factor if provided, repK should be 1 and numberOfRepetitions from TDRA should be assumed 1.
	+ Ericsson

Besides companies provided suggestion to improve the existing text.

* Vivo, DCM: improved description and emphasizing that repetition factor shall be one.
* IDC, Xiaomi, Samsung: improved description (slight difference by eventually similar).

Moderator’s observation:

It is recommended to conclude on Alt .2. Regarding the TP for Alt. 2, since it is redundant to emphasize if it is stated repetition is not supported, Moderator suggests to adopt Proposed TP by Samsung (Alternative 2) since cases of repetition and TBoMs are clearly separated (just to avoid potential issues 😊).

Moderator recommendation: Adopt Samsung’s TP (Alternative 2).

Table 2: Companies’ views and proposals

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| Vivo**Observation 2**: Since repetition for multi-PUSCH CG is not supported in Rel-18, it is guaranteed by proper gNB's configuration/indication that only repetition factor equal to one is applied to a multi-PUSCH CG configuration.**Proposal 2**: Adopt the TP2 for TS38.214 to clarify that Type A repetition is not supported for multi-PUSCH CG in Rel-18.

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| --------------------------------------------**TP2**--------------------------------------------6.1.2.3 Resource allocation for uplink transmission with configured grant…For PUSCH transmissions with a Type 1 or Type 2 configured grant, the number of (nominal) repetitions *K* to be applied to the transmitted transport block is provided by the indexed row in the time domain resource allocation table if *numberOfRepetitions* is present in the table; otherwise *K* is provided by the higher layer configured parameters *repK.* For a *configuredGrantConfig*, ~~If~~ if a UE is configured with higher layer parameter [*nrofSlots\_InCGperiod*], ~~in a~~ *~~configuredGrantConfig~~*~~,~~ the UE expects *K* shall be equal to one, and the UE does not support ~~neither repetition of the transmitted transport block nor~~ the TB processing over multiple slots ~~is supported~~ for the *configuredGrantConfig*.… |

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| Xiaomi***Proposal 4*: Proposed TP for Clause 6.1.2.3 of 38.214:**

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| \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchnaged text omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*For PUSCH transmissions with a Type 1 or Type 2 configured grant, the number of (nominal) repetitions *K* to be applied to the transmitted transport block is provided by the indexed row in the time domain resource allocation table if *numberOfRepetitions* is present in the table; otherwise *K* is provided by the higher layer configured parameters *repK.*For a *configuredGrantConfig*, ~~If~~ if a UE is configured with higher layer parameter [*nrofSlots\_InCGperiod*], ~~in a~~ *~~configuredGrantConfig~~*~~,~~ the UE does not support repetition and ~~neither repetition of the transmitted transport block nor~~ the TB processing over multiple slots ~~is supported~~ for the *configuredGrantConfig*.\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchnaged text omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* |

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| IDCIn our view, indicating in the TP that “the UE assumes the repetition factor equal to one”, and then “UE does not support repetition” seems unnecessary. For clarity and to avoid any misinterpretation with the text leading up to the TP (e.g. on repetitions and repK), we prefer removing the text “the UE assumes the repetition factor equal to one” from the TP. ***Proposal 1:* Adopt the following TP under Clause 6.1.2.3 in TS 38.214**

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| 6.1.2.3 Resource allocation for uplink transmission with configured grant\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchnaged text omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*For PUSCH transmissions with a Type 1 or Type 2 configured grant, the number of (nominal) repetitions *K* to be applied to the transmitted transport block is provided by the indexed row in the time domain resource allocation table if *numberOfRepetitions* is present in the table; otherwise *K* is provided by the higher layer configured parameters *repK.* For a *configuredGrantConfig*, ~~If~~ if a UE is configured with higher layer parameter [*nrofSlots\_InCGperiod*], ~~in a~~ *~~configuredGrantConfig~~*~~,~~ the UE does not support repetition, and the UE does not support ~~neither repetition of the transmitted transport block nor~~ the TB processing over multiple slots ~~is supported~~ ~~for the~~ *~~configuredGrantConfig~~*.\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchnaged text omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* |

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| DCM**Proposal 1: If a UE is configured with higher layer parameter [*nrofSlots\_InCGperiod*] in a *configuredGrantConfig*, UE doesn’t expect the repetition factor to be larger than 1.****Proposal 2: For RRC parameter configuration,*** ***nrofSlots\_InCGperiod* is NOT configured if *repK* is configured with value larger than 1 in *ConfiguredGrantConfig.***
* **UE doesn’t expect to be simultaneously configured with *nrofSlots\_InCGperiod* and *repK-17* in *ConfiguredGrantConfig*.**

**Proposal 3: For type 2 CG, if UE is configured with higher layer parameter [*nrofSlots\_InCGperiod*], UE doesn’t expect the TDRA row indicated by activation DCI indicates *numberOfRepetitions* value larger than 1.*** + **Adopt following TP.**

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| **TS 38.214, Clause 6.1.2.3****<\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*>**For PUSCH transmissions with a Type 1 or Type 2 configured grant, the number of (nominal) repetitions *K* to be applied to the transmitted transport block is provided by the indexed row in the time domain resource allocation table if *numberOfRepetitions* is present in the table; otherwise *K* is provided by the higher layer configured parameters *repK.* For PUSCH transmissions with a Type 2 configured grant, if UE is configured with *nrofSlots\_InCGperiod*, UE doesn’t expect the TDRA row indicated by activation DCI indicates *numberOfRepetitions* value larger than 1.**<\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*>** |

**Proposal 4: For type 2 CG, if UE is configured with higher layer parameter [nrofSlots\_InCGperiod], UE doesn’t expect the TDRA row indicated by activation DCI indicates *numberOfSlotsTBoMS* value larger than 1.*** **Adopt the following TP.**

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| **TS 38.214, Clause 6.1.2.3****<\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*>**For PUSCH transmissions with a Type 1 or Type 2 configured grant, the number of (nominal) repetitions *K* to be applied to the transmitted transport block is provided by the indexed row in the time domain resource allocation table if *numberOfRepetitions* is present in the table; otherwise *K* is provided by the higher layer configured parameters *repK.* For PUSCH transmissions with a Type 2 configured grant, if UE is configured with *nrofSlots\_InCGperiod*, UE doesn’t expect the TDRA row indicated by activation DCI indicates *numberOfSlotsTBoMS* value larger than 1.**<\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*>** |

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| Apple**Proposal 2: Reflect the following the specification text if further clarification is needed:*** **If the UE does not support Type-A PUSCH repetition, or the UE support Type-A PUSCH repetition but the network does not configure Type-A PUSCH repetition; in either case avoid the use of “repetition factor” in the specification text;**
* **The UE does support Type-A PUSCH repetition, and the network does configure Type-A PUSCH repetition, only an entry in a TDRA table with repetition factor can be referred by RRC signaling for Type-1 CG or DCI for Type-2 CG.**
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| Nokia***Proposal 2:*** *Further optimization for repetitions and multi-PUSCH CG is not needed, i.e., the repetition is not supported means to choose the row from TDRA table where the repetition factors is 1 and not overriding any other repetition factors by 1.*In any case, we think that further clarification details of that shall be captured in RRC and UE features and not in TS 38.214.***Proposal 3:*** *TS 38.214 already captures that the repetition is not supported for multi-PUSCH. Any further clarification, if needed, shall be captured in RRC or UE features specifications.*  |
| SamsungFor possibly capturing some statement in the specifications, two alternatives were identified in RAN1#114bis based on the following. The difference is that “Alternative 1” requires a UE (provided *nrofSlots\_InCGperiod*) to consider a TDRA indication that includes a repetition factor larger than one as being valid, ignore it (for a CG configuration associated with *nrofSlots\_InCGperiod*), and assume that the repetition factor is 1. In that respect, “Alternative 1” is a minor optimization over a direct statement of no repetition support in “Alternative 2” but it also only requires minor specification impact for the UE behavior regarding the indicated repetition factor depending on whether or not a CG configuration is associated with *nrofSlots\_InCGperiod*. At this stage, when there is no material operation impact, it is probably more appropriate to complete the specifications according to the simpler of the various options.

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| **Alternative 1**For PUSCH transmissions with a Type 1 or Type 2 configured grant, the number of (nominal) repetitions *K* to be applied to the transmitted transport block is provided by the indexed row in the time domain resource allocation table if *numberOfRepetitions* is present in the table; otherwise *K* is provided by the higher layer configured parameters *repK.* For a *configuredGrantConfig*, ~~If~~ if a UE is configured with higher layer parameter [*nrofSlots\_InCGperiod*], ~~in a~~ *~~configuredGrantConfig~~*~~,~~ the UE assumes the repetition factor equal to one and does not support repetition for the *configuredGrantConfig*, and the UE does not support ~~neither repetition of the transmitted transport block nor~~ the TB processing over multiple slots ~~is supported~~ for the *configuredGrantConfig*.**Alternative 2**For PUSCH transmissions with a Type 1 or Type 2 configured grant, the number of (nominal) repetitions *K* to be applied to the transmitted transport block is provided by the indexed row in the time domain resource allocation table if *numberOfRepetitions* is present in the table; otherwise *K* is provided by the higher layer configured parameters *repK.* For a *configuredGrantConfig*, ~~If~~ if a UE is configured with higher layer parameter [*nrofSlots\_InCGperiod*], ~~in a~~ *~~configuredGrantConfig~~*~~,~~ the UE does not support repetition and does not support ~~neither repetition of the transmitted transport block nor~~ the TB processing over multiple slots ~~is supported~~ for the *configuredGrantConfig*. |

***Observation 1****: If no support of repetitions or TBoMS for CG-PUSCH transmissions of a CG configuration associated with nrofSlots\_InCGperiod is to be captured in specifications, it is preferable to have a direct statement that does not introduce other impact on UE behavior/procedures.****Observation 2****: Absence of support for repetitions or TBoMS for CG-PUSCH transmissions of a CG configuration associated with nrofSlots\_InCGperiod is clear from UE features (to be reflected in TS 38.306) and a RAN1 specification update is not needed.* |
| LGProposal 2: For multi PUSCH CG configuration, UE doesn’t expect to be configured or activated with repetition factor other than one.  |
| OPPO***Proposal 4:*** ***UE does not expect to be indicated with an entry in the configured TDRA table for which the associated repetition factor is not equal to 1.*** |
| EricssonWe fail to understand the argument for complexity. Since it is a common procedures to ignore configurations and use an assumption instead. For example, there are many instances that UE ignores some fields when determining the DCI. Considering these operations are done per DCI, but the proposal here is about once at activation, the impact of complexity, if any is negligible. In the updated proposed TP, we have separated the case when repetition factor is obtained from *repK* or *numberOfRepetitions*. In case of former, the configuration of *repK* is only applicable to configured grant. Hence, it should be one, if it is configured. In case of the latter, *numberOfRepetitions* is obtained from TDRA and can be applied for dynamic scheduling. In case repetition is needed for dynamic scheduling, there is no need to waste a row in TDRA table.

|  |
| --- |
| 6.1.2.3 Resource allocation for uplink transmission with configured grant\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchnaged text omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*For PUSCH transmissions with a Type 1 or Type 2 configured grant, the number of (nominal) repetitions *K* to be applied to the transmitted transport block is provided by the indexed row in the time domain resource allocation table if *numberOfRepetitions* is present in the table; otherwise *K* is provided by the higher layer configured parameters *repK.* For a *configuredGrantConfig*, ~~If~~ if a UE is configured with higher layer parameter [*nrofSlots\_InCGperiod*], ~~in a~~ *~~configuredGrantConfig~~*~~,~~ the UE does not support repetition where the UE does not expect to be configured with a *repK* resulting in *K>*1, and ignores *numberOfRepetitions*, if provided. For a *configuredGrantConfig*, if a UE is configured with higher layer parameter [*nrofSlots\_InCGperiod*], and the UE does not support ~~neither repetition of the transmitted transport block nor~~ the TB processing over multiple slots ~~is supported~~ ~~for the~~ *~~configuredGrantConfig~~*.\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchnaged text omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* |

 |

### 2.2.1 Initial discussion

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

|  |  |
| --- | --- |
| Company | Comment |
| DOCOMO | Alt 2 is acceptable to us. Though we still feel it is better to clarify the exact UE behavior or restriction in the spec, we are fine with moderator’s suggestion to adopt Samsung’s Alternative-2 TP. Moreover, we think the restriction on “*nrofSlots\_InCGperiod*” configuration and “repK”/“repK-r17” configuration should be emphasized in RRC parameter. * **The parameter *nrofSlots\_InCGperiod* can be configured only when *repK* is configured as 1, and *repK-17* is not configured in *ConfiguredGrantConfig.***
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## 2.3 Issue#3: HARQ process ID for Multi-PUSCH CG

Moderator’s summary:

See Table 3.

* Issue3-1) Vivo, OPPO
	+ Provide TP for more consistent description of HARQ process ID and add description to also cover the case for the first CG PUSCH by reference to 38.321.
* Issue 3-2)Nokia
	+ Propose to make a Conclusion confirming description in 38.321 for HP UD determination for multi-PUSCH CG.

Moderator’s observation:

* Issue 3-1: The proposal makes sence for completeness since indeed it is not clear how the 1st one is determined in 38.214. Among the TPs, OPPO’s version is preferred. It is can cause confusion if K is numbered differently that in 38.321.
* Issue 3-2: Making the conclusion can be a safe approach and avoid potential issues in future.

Moderator’s recommendation:

* Issue 3-1: Adopt OPPO’s TP
* Issue 3-2: Endorse conclusion proposed by Nokia.

Table 3: Companies’ views and proposals

|  |  |
| --- | --- |
| Vivo:**Observation 1**: There is inconsistence between description for determination of HARQ process ID for multi-PUSCH CG in TS38.214 and corresponding agreement, depending on whether the first configured CG PUSCH occasion in a given CG period is valid or invalid.**Proposal 1**: Adopt the TP1 for TS38.214 to capture determination of HARQ process ID for the first configured CG PUSCH occasion and that for the remaining CG PUSCH occasions separately, in a period of multi-PUSCH CG.

|  |
| --- |
| --------------------------------**TP1**--------------------------------------------------------------6.1 UE procedure for transmitting the physical uplink shared channel…When the UE is configured *dl-OrJointTCI-StateList* or *ul-TCI-StateList*, the UE shall perform PUSCH transmission corresponding to a Type 1 configured grant or a Type 2 configured grant or a dynamic grant according to the spatial relation, if applicable, with a reference to the RS for determining UL Tx spatial filter. The RS is determined based on an RS configured with *qcl-Type* set to 'typeD' of the indicated *TCI-State* or an RS in the indicated *TCI-UL-State*. The reference RS in the indicated *TCI-State* can be a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*, or a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info.* The reference RS in the indicated *TCI-UL-State* can be a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*, a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info*, an SRS resource in an SRS resource set with the higher layer parameter *usage* set to 'beamManagement', or SS/PBCH block associated with the same or different PCI from the PCI of the serving cell. 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 after the first 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 due to collision with the DL symbol(s) indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, or a symbol(s) of an SS/PBCH block with index provided by *ssb-PositionsInBurst* as described in clause 11.1 of [6, TS 38.213]. HARQ process ID for the first configured PUSCH grant is determined as in clause 5.4.1 of [10, TS 38.321].… |

 |
| OPPOFor multi-PUSCHs CG configuration, HARQ process ID is determined for the first configured PUSCH and the remaining valid configured PUSCH(s) in a CG period, where the first configured PUSCH occasion can be either valid or invalid. Therefore the current description in TS38.214 CR for “*Kth (1 < K ≤ [nrofSlots\_InCGperiod]) valid configured PUSCH grant*” is either incomplete or incorrect. Because both HPID for the first configured PUSCH grant and HPID for the remaining valid configured PUSCH grant are specified in clause 5.4.1 of TS 38.321, we propose to remove the K-indexing from 38.214 CR, as in the following TP. ***Proposal 3: Adopt following TP for Clause 6.1 of TS38.214.***

|  |
| --- |
| 6.1 UE procedure for transmitting the physical uplink shared channel\*\*\*\*\*\*\*\*\*\*\*\*\*\* Unchanged parts omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\*When *[nrofSlots\_InCGperiod]* is configured for Type 1 configured grant or Type 2 configured grant, HARQ process ID for the ~~K~~~~th~~ ~~(1 < K ≤ [~~*~~nrofSlots\_InCGperiod]~~*~~)~~ first configured PUSCH grant and each subsequent valid configured PUSCH grant within a *periodicity* of the configuration is determined as in clause 5.4.1 of [10, TS 38.321], excluding invalid configured PUSCH grant(s) that are not transmitted due to collision with the DL symbol(s) indicated by tdd-UL-DL-ConfigurationCommon or tdd-UL-DL-ConfigurationDedicated if provided, or a symbol(s) of an SS/PBCH block with index provided by ssb-PositionsInBurst as described in clause 11.1 of [6, TS 38.213].\*\*\*\*\*\*\*\*\*\*\*\*\*\* Unchanged parts omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\* |

 |
| NokiaRAN2 sent an LS with updated formula for determination of HARQ process ID where the typo from previous RAN1 agreement was corrected [2]. Additionally, the following text was endorsed discussed in RAN2#123 [3] as a part of running CR for TS 38.321:

|  |
| --- |
| <omitted text> <omitted text> |

We propose that RAN1 confirms the updates provided from RAN2 and is captured in TS 38.321. It is also proposed to capture the confirmation to chairman’s notes for further reference to close the discussion.***Proposal 1****: RAN1 confirms the HARQ process ID determination for multi-PUSCH per CG period as in TS 38.321 and that this is captured to chairman’s notes as conclusion.* |

### 2.3.1 Initial discussion

**Question:** What is your view about the issues 3-1 and 3-2 raised above and the corresponding proposal, as well as Moderator’s observation and recommendation? Do you have a different view as compared to the recommendation?

|  |  |
| --- | --- |
| Company | Comment |
| DOCOMO | Agree with Moderator’s recommendation. |
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## 2.4 Issue#4: UTO-UCI indication and CG Repetition

Moderator’s summary:

See Table 4.

CMCC proposes to clarify that a 1 bit of UTO-UCI bit corresponds to a repetition bundle. QC finds this approach reasonable, however not urgent for Rel-18.

Moderator’s observation:

This issue was raised last meeting by LG. The discussion last meeting had a recommendation that seems to be agreeable. However, since the issue is raised again, it is important to clarify.

* Approach 1:
	+ When the bit is “0”, it is associated with one of the repetitions in the bundle.
		- Each repetition occupies a transmission occasion.
	+ When the bit is “1”, it is associated with one transmission occasion (and no repetition due to lack of TB).
* Approach 2:
	+ 1 UTO-UCI bit per bundle

The understanding form last meeting was Approach 1 that probably doesn’t need spec impact.

But it seems Approach 2 (suggested by CMCC and previously LG) is simpler.

Moderator’s recommendation:

It is reasonable to adopt Approach 2 and CMCC TP (in principal).

Table 4: Companies’ views and proposals

|  |  |
| --- | --- |
| CMCC**Proposal 1**. Regarding the mapping rule between a UTO-UCI bitmap and CG PUSCH TOs when repetition of a transmitted TB and UTO-UCI are supported in a legacy CG configuration, support that the CG PUSCH TOs corresponding to K repetitions of a TB are mapped to 1 bit in the bitmap of UTO-UCI.**Proposal 2**. If repetition of a transmitted TB and UTO-UCI are supported in a legacy CG configuration, only transmit UTO-UCI in the CG PUSCH TOs corresponding to the first repetition of a transmitted TB.**Proposal 3**. Regarding the mapping rule between a UTO-UCI bitmap and CG PUSCH TOs when TBoMS and UTO-UCI are supported in a legacy CG configuration, support that the CG PUSCH TOs corresponding to N consecutive slots allocated for TBoMS are mapped to 1 bit in the bitmap of UTO-UCI.**Proposal 4**. Adopt the following text proposal to Clause 9.3.1 of TS 38.213.

|  |
| --- |
| \*\*\* Unchanged text is omitted \*\*\***9.3.1 UE procedure for reporting UTO-UCI**If the UE is provided *nrof\_UTO\_UCI* with value equal to  in *configuredGrantConfig* of a CG-PUSCH configuration, the UE multiplexes UTO-UCI represented by a bitmap of  bits in each CG-PUSCH transmission for the CG-PUSCH configuration. The  bits of UTO-UCI, , have a one-to-one mapping to  subsequent CG-PUSCH TOs in ascending order of start time. For unpaired spectrum operation, the  subsequent CG-PUSCH TOs exclude invalid ones where a UE does not transmit a PUSCH due to collision of the PUSCH with DL symbol(s) indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, or with symbol(s) of an SS/PBCH block with index provided by *ssb-PositionsInBurst*, based on the procedures in Clause 11.1. A bit value of ‘0’ indicates that the UE may transmit CG-PUSCH, and a bit value of ‘1’ indicates that the UE will not transmit CG-PUSCH, in a corresponding CG-PUSCH TO. When the UE indicates by UTO-UCI a value of ‘1’ for a CG-PUSCH TO, the UE continues to indicate the value of ‘1’ for the CG-PUSCH TO by UTO-UCI multiplexed in subsequent CG-PUSCH transmissions, and the UE does not transmit CG-PUSCH in the CG-PUSCH TO. If the UE is also provided *repK* with a value equal to K in *configuredGrantConfig* of the CG-PUSCH configuration or *numberOfRepetitions* with a value equal to K is present in the indexed row in the time domain resource allocation table, follow the above mapping procedure by treating the CG-PUSCH TOs corresponding to K repetitions of a TB as a bundle of CG-PUSCH TOs, which is mapped to one bit of UTO-UCI. If *numberOfSlotsTBoMS* with a value equal to N is present in the indexed row in the time domain resource allocation table, follow the above mapping procedure by treating the CG-PUSCH TOs corresponding to N consecutive slots allocated for TBoMS as a bundle of CG-PUSCH TOs, which is mapped to one bit in the bitmap of UTO-UCI.\*\*\* Unchanged text is omitted \*\*\* |

 |
| QualcommIn XR UE feature discussions in RAN1 #114bis [6], it was agreed that FG 50-2 for UTO-UCI is independent of FG 50-1/1a for the Rel-18 multi-PUSCH CG. This means UTO-UCI is applicable to both the Rel-18 multi-PUSCH CG and the legacy CG with one PUSCH TO in the period. Although the Rel-18 multi-PUSCH CG does not support repetition, the legacy CG may have repetition enabled for a TB to be transmitted over multiple CG PUSCH TOs. It was proposed in [5] that when PUSCH repetition is configured for a CG indicated by UTO-UCI, each bit in the UTO-UCI indicates whether the entire repetition bundle is “unused” or not. This is technically reasonable as either the UE has more data to transmit or not. However, the current specification is not broken without this optimization. On the other hand, repetition is important for UL coverage enhancements in resolving the zero capacity issue for AR in Urban Macro environments [7]. Based on these, we think it is necessary to specify CG PUSCH repetition related enhancements in Rel-19 including the UTO-UCI indication of CG PUSCH repetitions.***Proposal 3: CG PUSCH repetition related enhancements including repetition for Rel-18 multi-PUSCH CG and one bit in UTO-UCI indicating a repetition bundle can be discussed in Rel-19.*** |

### 2.4.1 Initial discussion

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

|  |  |
| --- | --- |
| Company | Comment |
| DOCOMO | Firstly, we agree with moderator’s observation that Approach 1 doesn’t require spec impact. But we are not sure whether the benefit of “Approach 2 is simpler” is well justified. In our understanding, in current specification, it is possible that some of the CG repetitions are not used and other CG repetitions are used, depending on staring RV configuration.

|  |
| --- |
| 6.1.2.3.1 Transport Block repetition for uplink transmissions of PUSCH repetition Type A with a configured grantThe procedures described in this clause apply to PUSCH transmissions of PUSCH repetition Type A with a Type 1 or Type 2 configured grant. The higher layer parameter *repK-RV* defines the redundancy version pattern to be applied to the repetitions. If *cg-RetransmissionTimer* is provided, the redundancy version for uplink transmission with a configured grant is determined by the UE. If the parameter *repK-RV* is not provided in the *configuredGrantConfig* and *cg-RetransmissionTimer* is not provided, the redundancy version for uplink transmissions with a configured grant shall be set to 0. If the parameter *repK-RV* is provided in the *configuredGrantConfig* and *cg-RetransmissionTimer* is not provided, for the *n*th transmission occasion among *K* repetitions, *n*=1, 2, …, *K*, it is associated with *(mod(((n-mod(n, N))/N)-1,4)+1)th* value in the configured RV sequence, where *N*=1. If a configured grant configuration is configured with *startingFromRV0* set to *'off'*, the initial transmission of a transport block may only start at the first transmission occasion of the *K* repetitions. Otherwise, the initial transmission of a transport block may start at - the first transmission occasion of the *K* repetitions if the configured RV sequence is {0,2,3,1},- any of the transmission occasions of the *K* repetitions that are associated with RV=0 if the configured RV sequence is {0,3,0,3},- any of the transmission occasions of the *K* repetitions if the configured RV sequence is {0,0,0,0}, except the last transmission occasion when *K≥8*. \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*6.1.2.3.2 Transport Block repetition for uplink transmissions of PUSCH repetition Type B with a configured grantThe procedures described in this Clause apply to PUSCH transmissions of PUSCH repetition type B with a Type 1 or Type 2 configured grant.For PUSCH transmissions with a Type 1 or Type 2 configured grant, the nominal repetitions and the actual repetitions are determined according to the procedures for PUSCH repetition Type B defined in Clause 6.1.2.1. The higher layer configured parameters *repK-RV* defines the redundancy version pattern to be applied to the repetitions. If the parameter *repK-RV* is not provided in the *configuredGrantConfig*, the redundancy version for each actual repetition with a configured grant shall be set to 0. Otherwise, for the *n*th transmission occasion among all the actual repetitions (including the actual repetitions that are omitted) of the *K* nominal repetitions, it is associated with *(mod(((n-mod(n, N))/N)-1,4)+1)th* value in the configured RV sequence, where *N* = 1. If a configured grant configuration is configured with *startingFromRV0* set to 'off', the initial transmission of a transport block may only start at the first transmission occasion of the actual repetitions. Otherwise, the initial transmission of a transport block may start at - the first transmission occasion of the actual repetitions if the configured RV sequence is {0,2,3,1},- any of the transmission occasions of the actual repetitions that are associated with RV=0 if the configured RV sequence is {0,3,0,3},- any of the transmission occasions of the actual repetitions if the configured RV sequence is {0,0,0,0}, except the actual repetitions within the last nominal repetition when *K≥8*. \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*6.1.2.3.3 Transport Block repetition for uplink transmissions of TB processing over multiple slots with a configured grantThe procedures described in this clause apply to PUSCH transmissions of TB processing over multiple slots with a Type 2 configured grant. The higher layer parameter *repK-RV* defines the redundancy version pattern to be applied to the repetitions. If the parameter *repK-RV* is not provided in the *configuredGrantConfig*, the redundancy version for uplink transmissions with a configured grant shall be set to 0. If the parameter *repK-RV* is provided in the *configuredGrantConfig*, the *n*th transmission occasion among $N∙K$transmissions occasions, *n*=0,1, …, $N∙K$ *-1*, is associated with *(mod((n-mod(n, N))/N,4)+1)th* value in the configured RV sequence. When *K*=1, or when *K*>1 and the configured grant configuration is configured with startingFromRV0 set to 'off', the initial transmission of the transport block may only start at the first transmission occasion of the $N∙K$ transmission occasions. Otherwise, the initial transmission of the transport block may start at- The first transmission occasion of the $N∙K$ transmission occasions if the configured RV sequence is {0,2,3,1}.- Any transmission occasion n associated with RV=0, and for which n mod N =0, if the configured RV sequence is {0,3,0,3} or {0,0,0,0}.\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* |

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## 2.5 Issue#5: Incomplete specification of SLIV

Moderator’s summary:

See Table 5.

ZTE reasons that the specification of SLIV is incomplete.

Moderator’s observation:

From the description of cg-nrofSlot and nrofSlots-InCGperiod is clear that when CG PUSCH is configured across slots, these parameters should be configured. Then, the highlighted green text in Table 5 is clearly only applicable when there is PUSCH across slots, i.e. when one of cg-nrofSlot and nrofSlots-InCGperiod is configured. Henoodice, it is not clear if specification is complete.

However, if there is a preference to clarify more, the TP by ZTE can be adopted, there is no need to mention “*cg-nrofPUSCH-InSlot”* since configuration of this parameter is optional and consider the following update:

* if *cg-nrofSlots* or *[nrofSlots\_InCGperiod]* is configured

Moderator’s recommendation:

If the group supports, adopt the proposed TP ZTE, including the suggested update by Moderator.

Table 5: Companies’ views and proposals

|  |  |
| --- | --- |
| ZTEProposes the following TP, claiming that the specification of SLIVs is incomplete. The time domain allocation of NR-U CG (if *cg-nrofSlots* and *cg-nrofPUSCH-InSlot* are configured) is described in clause 6.1.2.3 of TS38.214 (V18.0.0) cited as below. However, in comparison to release-17 version, a sentence was removed due to the concern of duplication description for both NR-U and multi PUSCH CG. In consequence, the time domain allocation of CG configuration in case of NR-U is **incomplete**. **Proposal 1**: Adopt TP#1 for Clause 6.1.2.3 of TS38.214.

|  |
| --- |
| **TP#1** **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 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 *cg-nrofSlots and cg-nrofPUSCH-InSlot* are configured or if *[nrofSlots\_InCGperiod]* is configured. 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 > |

 |

### 2.5.1 Initial discussion

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

|  |  |
| --- | --- |
| Company | Comment |
| DOCOMO | Fine with it. |
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## Issue#6: UTO-UCI and HARQ-ACK multiplexing

Moderator’s summary:

Sharp has raised few issues regarding UTO-UCI and HARQ-ACK multiplexing and suggests to clarify few aspects as mentioned in the proposals. For detailed discussion, please review Sharp’s contribution.

Moderator’s observation:

Regarding the questions raised, Moderator’s understanding is as the following:

* Regarding Proposal 1: and Proposal 2 With respect to CG PUSCH with UTO-UCI, there is no functionality to enable/disable joint multiplexing of HARQ-ACK in CG PUSCH. The specified behaviour is as the following and no need to additional condition. In other words:
	+ if a HARQ-ACK of the same priority as CG PUSCH, is multiplexed in CG PUSCH, it would be jointly encoded with UTO-UCI.
	+ if a HARQ-ACK of the different priority as CG PUSCH, is multiplexed in CG PUSCH, it would be separately encoded with UTO-UCI.
* Regarding Proposal 3 and 4: Reading the explanations in the contribution, **if Moderator understands correctly,** it seems the underlying issue that has caused confusion in the “cited” description is the following:
	+ In the text below, the overlapping scenario is a CG PUSCH with CG-UCI of priority index 1 overlapping with LP PUCCH and HP PUCCH and CSI PUCCH. Which means PUSCH has the same priority as CG PUSCH, i.e. priority index 1. However, in order to perform encoding and multiplexing on PUSCH by using procedures in clause 6.2.7, some assumptions are made for UCIs, as well as PUSCH. For example, HARQ-ACK with priority index 0 is assumed like CSI part 1 (but it doesn’t mean it is changed to CSI part 1) and also, PUSCH priority is assumed 0 (where originally was 1). This is to facilitate using the encoding and multiplexing procedures in clause 6.2.7.
	+ With that understanding, the existing specifications for UTO-UCI should be clear as well, similarly to CG-UCI.

- otherwise, the coded UCI bits are multiplexed onto PUSCH according to the procedures in Clause 6.2.7 by taking HARQ-ACK with priority index 1 if any as HARQ-ACK, taking CG-UCI associated with priority index 1 if any as CG-UCI, taking HARQ-ACK with priority index 0 as CSI part 1, and taking CSI part 1 as CSI part 2 if CSI part 1 is also transmitted on the PUSCH and the PUSCH is associated with priority index 0.

Moderator’s recommendation: Companies are encouraged to review Sharp’s contribution and also reflect whether Moderator’s understanding is correct.

|  |
| --- |
| SharpIn this contribution, we studied the detailed cases for UTO-UCI and HARQ-ACK multiplexing on PUSCH, and want to clarify the outcomes of some subcases from the current specifications, esp. for multiplexing of UTO-UCI with priority index 1 and/or HARQ-ACK with priority index 1 on a PUSCH with priority index 1. We proposed the following:**Proposal 1: RAN1 to clarify/verify that when the UTO-UCI and HARQ-ACK have the same priority, they are always joint encoded and transmitted on a PUSCH.****Proposal 2: RAN1 to clarify whether additional dropping rules should be specified if the condition “UTO-UCI and HARQ-ACK joint coding is not enabled” is supported.****Proposal 3: RAN1 should clarify the behaviors for different cases of the condition “HARQ-ACK bits associated with priority index 1 and/or CG-UCI associated with priority index 1.”** **Proposal 4: For clarification, RAN1 can list the CG-UCI and HARQ-ACK combinations, and split the “otherwise” with separate subcases for different PUSCH priorities.** |

### 2.6.1 Initial discussion

**Question:** What is your view about the issues raised above and the corresponding proposal, as well as Moderator’s observation and recommendation? Do you have a different view as Moderator? Please provide your view and clarification as requested by Sharp.

|  |  |
| --- | --- |
| Company | Comment |
| DOCOMO | Agree with moderator that the current spec is clear.  |
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## Issue#7: Editorial correction

Moderator’s summary:

HW have identified few editorial inconsistencies in specifications that should be addressed.

Moderator’s recommendation: Endorse the corresponding TP.

|  |
| --- |
| HW***Proposal 1:*** ***Remove the bracket in*** $Q\_{ACK/[UTO-UCI]}^{'}$ ***in TS 38.214.******Proposal 2:*** ***Remove a redundant minus operation in the equation*** $\left⌈α∙\sum\_{l=0}^{N\_{symb,all}^{PUSCH}-1}M\_{sc}^{UCI}\left(l\right)\right⌉--Q\_{ACK/[UTO-UCI]}^{'}-Q\_{CSI-1}^{'}$ ***in TS 38.214.*** |

### 2.7.1 Initial discussion

**Question:** Do you have a different view as compared to the recommendation?

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| --- | --- |
| Company | Comment |
| DOCOMO | Support moderator’s recommendation. |
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# Other 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.

## Issue#3-1: Cell DRX operation with invalid CG occasions

Moderator’s summary:

LG suggests that include CG occasion during Cell DRX as additional condition for invalid CG.

Moderator’s observation:

It is cleaner to remain the original conditions for determining invalidity of a CG PUSCH. Adding new conditions based on new features, e.g. those specified by NES (AI 8.5.2), unnecessary make the feature complicated. Because if a new feature adds a new condition for not transmitting CG PUSCH, the UE does not transmit that CG PUSCH. In worst case, the UE indicates as “unused” when possible. Also, NW is aware not to except any GH PUSCH during DRX off in case of support of NES feature. Hence, it does not seem to be necessary.

Moderator recommendation:

Not to add cell DRX inactive period as the new condition for invalidity of a CG PUSCH.

|  |  |
| --- | --- |
| LGFor the validity of CG occasions, there is a note in the RAN1 agreement like following:

|  |
| --- |
| 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. |

However, a lot of deterministic invalid case had been specified in 11.1, even some cases are being specified after the agreement above. One of them is Cell DRX operation. It was agreed that UE does not transmit on CG occasions during cell DRX inactive periods in AI 8.5.2. Cell DRX operation is basically periodic so there are lots of similarity to collision handling with TDD configurations. Considering that, it can be considered to add cell DRX inactive period as one of the cases that make the invalid CG occasion. Otherwise, it is difficult to indicate actual valid CG occasions right after the cell DRX inactive period via UTO-UCI by CG PUSCHs before the cell DRX inactive period. In addition, HARQ process ID allocated to CG PUSCHs on cell DRX inactive period may not be utilized. The corresponding TP is provided in [1].Proposal 1: Add cell DRX inactive period as additional case of invalid CG occasion.  |

## Issue#3-2: Uplink skipping

Moderator’s summary:

OPPO raised an issue related to UL skipping operation in combination with UTO-UCI.

Moderator’s observation:

During the WI, early on it was commonly understood in RAN1 that UL skipping related issues should be discussed in RAN2. It is not clear why RAN1 should discuss 38.321 specifications and inform RAN2 of changes, where RAN2 is responsible for specification of this feature too. The issue can be raised in RAN2.

Moderator’s recommendation: No need to discuss this topic in RAN1.

|  |  |
| --- | --- |
| OPPOAccording to TS38.321, if R16 uplink skippingis enabled for CG, and there is UCI to be multiplexed on a CG PUSCH transmission, MAC layer would generate the MAC PDU for the HARQ entity. Meanwhile, as described in TS38.213 (copied to Annex for reference), UTO-UCI is supposed to be multiplexed in all of CG PUSCH transmissions. The combination of these two facts drive a derivation that, when both *enhancedSkipUplinkTxConfigured-r16* and *nrof\_UTO\_UCI* are configured to a UE, MAC layer would generate MAC PDU for every CG PUSCH occasion, which means every CG-PUSCH occasion would be “not unused” for sure; in other words, the indication by UTO-UCI is always predictable and therefore useless. ***Observation 1: Within the current RAN2 specification, when both enhancedSkipUplinkTxConfigured-r16 and nrof\_UTO\_UCI are configured to a UE, MAC layer always generates MAC PDU, which makes UTO-UCI indication always predictable and therefore useless.***In order to avoid the above unreasonable situation, we propose that if R16 uplink skipping is enabled for CG and no data is available for a CG PUSCH transmission with UTO-UCI, MAC does not generate a MAC PDU if there is no UCI except UTO-UCI to be multiplexed on this PUSCH transmission as specified in TS 38.213.***Proposal 1: Send to RAN2 the following recommendation on the update of TS38.321:***

|  |
| --- |
| 5.4.3.1.3 Allocation of resources\*\*\*\*\*\*\*\*\*\*\*\*\*\* Unchanged parts omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\*The MAC entity shall:1> if the MAC entity is configured with *enhancedSkipUplinkTxDynamic* with value *true* and the grant indicated to the HARQ entity was addressed to a C-RNTI, or if the MAC entity is configured with *enhancedSkipUplinkTxConfigured* with value *true* and the grant indicated to the HARQ entity is a configured uplink grant:2> if there is no UCI except UTO-UCI to be multiplexed on this PUSCH transmission as specified in TS 38.213 [6]; and2> if there is no aperiodic CSI requested for this PUSCH transmission as specified in TS 38.212 [9]; and2> if the MAC PDU includes zero MAC SDUs; and2> if the MAC PDU includes only the periodic BSR and there is no data available for any LCG, or the MAC PDU includes only the padding BSR:3> not generate a MAC PDU for the HARQ entity.\*\*\*\*\*\*\*\*\*\*\*\*\*\* Unchanged parts omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\* |

. |

## Issue#3-3: Extension of UTO-UCI to multiple CG

Moderator’s summary:

FW suggests deprioritizing extension of UTO-UCI to multiple CG configuration.

Moderator’s observation: This topic is already concluded.

**Conclusion (RAN1#114)**

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.

Moderator’s recommendation: No need to discuss this topic in Re-18.

|  |
| --- |
| FW **Proposal 1**: Any issue relevant to dynamic indication of unused CG PUSCH occasion(s) for multiple CG configurations should be deprioritized in Rel-18. |

## Issue#3-4: Collision resolution of CG-PUSCHs

Moderator’s summary:

Qualcomm discusses collision resolution of CG-PUSCHs needs to be addressed, but in Rel-19.

Moderator’s observation: This was discussed last meeting and it was concluded among the group that it is more a RAN2 topic. Qualcomm also does not suggest todiscuss this topic as a maintenance issue in RAN1.

Moderator’s recommendation: No need to discuss this topic in RAN1.

|  |
| --- |
| Qualcomm***Proposal 4: UTO-UCI can indicate which CG PUSCH TO of multiple colliding CG PUSCH TOs is used if UTO-UCI is extended to indicate CG PUSCH TOs of multiple CG configurations. This can be discussed in Rel-19 as UTO-UCI enhancements.*** |

## Issue#3-5: Default number of Multi-PUSCHs

Moderator’s summary:

Xiaomi proposes to define a default value for number of consecutive slots for multi-PUSCH CG.

Moderator’s observation:

Moderator’s understanding is that since it is an optional capability, it the UE indicates the support, it would indicate the number 16 or 32, based on its capability. Therefore, it is not clear the ambiguity issue and the need for a default value.

Moderator’s recommendation:

No need to specify a default value for number of slot for multi-PUSCH CG.

|  |
| --- |
| Xiaomi**Observation 1**: It is beneficial for avoiding unnecessary ambiguity to determine a default value when UE does not indicate the corresponding capability.**Proposal 1**: 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 |

## Issue#3-6: UTO-Offset

Moderator’s summary:

Xiaomi, similar to previous meeting, proposes to define UTO-Offset for UTO-UCI indication.

Moderator’s observation:

As explained last meeting, based on the following agreement and conclusion, the UTO-Offset is not supported.

**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

**Conclusion**

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

Moderator’s recommendation: No need to discuss this topic in RAN1.

|  |
| --- |
| Xiaomi**Observation 2**: The gNB cannot be guaranteed to reuse the resource corresponding to the unused CG PUSCH TOs without UTO\_offset.**Proposal 2**: Support configuration of UTO\_offset as the offset value* A higher layer parameter is used to configure the offset value.
* The maximum value of UTO\_offset is not greater than the number of CG PUSCH TO in a CG period.
 |

## 3.1 Initial discussion

**Question:** What is your view about the issues 3-1 to 3-6 raised above and the corresponding proposal, as well as Moderator’s observation and recommendation? Do you have a different view as compared to the recommendation?

|  |  |
| --- | --- |
| Company | Comment |
| DOCOMO | Agree with Moderator’s observation and recommendation for Issue #3-1, 3-2, 3-3, 3-4, 3-5, 3-6. |
|  |  |
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# UE features related topics

The topics below are related to UE features discussion under AI 8.16.6.

**Moderator’s comment:** From Moderator’s point of view these discussions should take place under UE discussions. Discussing them under maintenance can cause conflict and inconsistency. Based on the outcome of discussions under AI 8.16.6, one can follow-up the discussion under AI 8.6 if there are maintenance issues to resolve.

|  |
| --- |
| OPPO***Proposal 2: When*** ***single-PUSCH CG configuration(s) and multi-PUSCHs CG configuration(s) are configured to a UE, both HARQ process number and RV fields in a DCI format are used to indicate activation or release of a type-2 CG configuration. One of the following options can be selected:**** + ***Option 1: Single-PUSCH type-2 CG configuration and multi-PUSCHs type-2 CG configuration have independent configuration index space.***
		- ***RV field is used to distinguish CG configuration index space between single-PUSCH type-2 CG configuration and multi-PUSCHs type-2 CG configuration.***
		- ***HARQ process number field indicates, as in R16, the CG configuration index for either single-PUSCH type-2 CG configuration or multi-PUSCHs type-2 CG configuration, depending on the identification by RV field.***
	+ ***Option 2: Single-PUSCH type-2 CG configuration and multi-PUSCHs type-2 CG configuration share the same configuration index space.***
		- ***RV field is used as MSB and HARQ process number field is used as LSB to indicate type-2 CG configuration index, for which the value rang can be larger than in R16.***
 |
| ZTE**Observation 1**: Joint release of multiple multi-PUSCHs CG configurations can be supported without physical layer specification change.**Observation 2**: If the feature of joint release of multiple multi-PUSCHs CG configuration is not supported, more specification impact may be needed.**Proposal 2**: Support to introduce a new UE feature of joint release of multiple multi-PUSCHs CG configurations (e.g., FG 50-1b). |
| CATT**Proposal 1**: UE capability for FG 50-1a multiple CG PUSCH configurations for XR should NOT have the pre-requisite of FG 11-9 the support of maximum number of CG configurations for URLLC.**Proposal 2**: The candidate values for component 1 can be more flexible with fine granularity, such as {2, 3, ... , 12}, the component 2: {2, ..., 32}.**Proposal 3**: The UE feature FG 50-1a for XR enhancement in RAN1 should be supported as Table 2. |
| Qualcomm***Proposal 1: Support the transmission of UTO-UCI in CG PUSCH in unlicensed bands when the CG PUSCH does not include CG-UCI. The support is based on a per band UE feature FG 50-2 for UTO-UCI.*** |

# 5 Conclusion

TBD

# References

|  |  |  |
| --- | --- | --- |
| [**R1-2310832**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2310832.zip) | Remaining issues of XR-specific capacity enhancements | FUTUREWEI |
| [**R1-2310995**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2310995.zip) | Discussion on remaining issues of XR | ZTE, Sanechips |
| [**R1-2311104**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311104.zip) | Remaining issue on XR specific capacity enhancements | vivo |
| [**R1-2311273**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311273.zip) | Remaining issues on XR specific capacity enhancements | OPPO |
| [**R1-2311349**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311349.zip) | Design of Multiple CG Occasions and unused CG occasion feedback | CATT |
| [**R1-2311408**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311408.zip) | Remaining issues on XR-specific capacity enhancements | xiaomi |
| [**R1-2311489**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311489.zip) | Remaining issues on XR-specific capacity enhancements | CMCC |
| [**R1-2311533**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311533.zip) | Remaining issues on XR-specific capacity enhancements | InterDigital, Inc. |
| [**R1-2311628**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311628.zip) | Discussion on maintenance on XR enhancements | NTT DOCOMO, INC. |
| [**R1-2311691**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311691.zip) | Remaining issues in XR-specific capacity enhancements | Apple |
| [**R1-2311732**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311732.zip) | XR-specific capacity enhancements | Nokia, Nokia Shanghai Bell |
| [**R1-2311851**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311851.zip) | Remaining issues on XR | Samsung |
| [**R1-2311897**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311897.zip) | Remaining issues on XR-specific capacity enhancements | LG Electronics |
| [**R1-2311905**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311905.zip) | On Maintenance of XR enhancements for NR | Ericsson |
| [**R1-2311953**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2311953.zip) | Clarification on UTO-UCI and HARQ-ACK multiplexing on PUSCH | Sharp |
| [**R1-2312043**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312043.zip) | Maintenance on XR Enhancements | Qualcomm Incorporated |
| [**R1-2312217**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_115/Docs/R1-2312217.zip) | Maintenance of CG enhancements for XR capacity | Huawei, HiSilicon |

# 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%3A%5CUsers%5Cyounsun%5CDocuments%5C3GPP%20documents%5CRAN1%20tdocs%5CTSGR1_114%5CDocs%5CR1-2306379.zip) is agreed. LS in [R1-2308654](file:///C%3A%5CUsers%5Cyounsun%5CDocuments%5C3GPP%20documents%5CRAN1%20tdocs%5CTSGR1_114%5CDocs%5CR1-2308654.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%3A%5CUsers%5Cyounsun%5CDocuments%5C3GPP%20documents%5CRAN1%20tdocs%5CTSGR1_114%5CDocs%5CR1-2308659.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 agreement

|  |
| --- |
| **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 |

## RAN1#114bis agreements and conclusions

**Agreement**

Adopt TP1-1 below for Clause 6.1 of 38.214:

|  |  |
| --- | --- |
| ***Reason for change:*** | For determination of HARQ process ID for a multi-PUSCHs CG, the current specifications refer to the procedures in clause 11.1 of 38.213 which includes cases corresponding to collision with dynamic as well as semi-static transmissions or symbol direction indications.It is important to determine whether a CG PUSCH TO is valid or invalid for HARQ process ID determination of a multi-PUSCHs CG. In the corresponding agreements, it was clarified by the following Note the cases which are relevant for determining valid/invalid CG PUSCH TOs for HARQ process ID determination: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.Hence, it should be clarified which collision cases in clause 11.1 are relevant for this purpose. |
|  |  |
| ***Summary of change:*** | Add description in clause 6.1 that for the procedures in clause 11.1, the CG PUSCH TO collision with DL symbol(s) indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated or SSB* results in an invalid CG PUSCH TO. |
|  |  |
| ***Consequences if not approved:*** | The definition of an invalid CG PUSCH has not been clearly captured in the specifications and results in inconsistency for the associated HARQ process ID determination procedures.  |
| 6.1 UE procedure for transmitting the physical uplink shared channel\*\*\*\*\*\*\*\*\*\*\*\*\*\* Unchanged parts omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\*When the UE is configured *dl-OrJointTCI-StateList* or *ul-TCI-StateList*, the UE shall perform PUSCH transmission corresponding to a Type 1 configured grant or a Type 2 configured grant or a dynamic grant according to the spatial relation, if applicable, with a reference to the RS for determining UL Tx spatial filter. The RS is determined based on an RS configured with *qcl-Type* set to 'typeD' of the indicated *TCI-State* or an RS in the indicated *TCI-UL-State*. The reference RS in the indicated *TCI-State* can be a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*, or a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info.* The reference RS in the indicated *TCI-UL-State* can be a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*, a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info*, an SRS resource in an SRS resource set with the higher layer parameter *usage* set to 'beamManagement', or SS/PBCH block associated with the same or different PCI from the PCI of the serving cell. 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 due to collision with the DL symbol(s) indicated by tdd-UL-DL-ConfigurationCommon or tdd-UL-DL-ConfigurationDedicated if provided, or a symbol(s) of an SS/PBCH block with index provided by ssb-PositionsInBurst as described in clause 11.1 of [6, TS 38.213].\*\*\*\*\*\*\*\*\*\*\*\*\*\* Unchanged parts omitted\*\*\*\*\*\*\*\*\*\*\*\*\*\* |

**Agreement**

Adopt TP1-2 below for Clause 9.3.1 of 38.213:

|  |  |
| --- | --- |
| ***Reason for change:*** | For UTO-UCI indication for a configured grant, the current specifications refer to the procedures in clause 11.1 of 38.213 which includes cases corresponding to collision with dynamic as well as semi-static transmissions or symbol direction indications.It is important to determine whether a CG PUSCH TO is valid or invalid since the UTO-UCI indication is applicable only to valid CG PUSCH TOs. In the corresponding agreements, it was clarified by the following Note the cases which are relevant for determining valid/invalid CG PUSCH TOs for UTO-UCI indication: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.Hence, it should be clarified which collision cases in clause 11.1 are relevant for this purpose. |
|  |  |
| ***Summary of change:*** | Add description in clause 9.3.1 that for the procedures in clause 11.1, the CG PUSCH TO collision with DL symbol(s) indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated or SSB* results in an invalid CG PUSCH TO. |
|  |  |
| ***Consequences if not approved:*** | The definition of an invalid CG PUSCH has not been clearly captured in the specifications and results in inconsistency for the associated UTO-UCI indication procedures. |
| 9.3.1 UE procedure for reporting UTO-UCIIf the UE is provided *nrof\_UTO\_UCI* with value equal to $O^{UTO-UCI}$ in *configuredGrantConfig* of a CG-PUSCH configuration, the UE multiplexes UTO-UCI represented by a bitmap of $O^{UTO-UCI}$ bits in each CG-PUSCH transmission for the CG-PUSCH configuration. The $O^{UTO-UCI}$ bits of UTO-UCI, $\tilde{o}\_{0}^{UTO-UCI}, \tilde{o}\_{1}^{UTO-UCI}, …, \tilde{o}\_{O^{UTO-UCI}-1}^{UTO-UCI}$, have a one-to-one mapping to $O^{UTO-UCI}$ subsequent CG-PUSCH TOs in ascending order of start time. For unpaired spectrum operation, the $O^{UTO-UCI}$ subsequent CG-PUSCH TOs exclude invalid ones where a UE does not transmit a PUSCH due to collision of the PUSCH with the DL symbol(s) indicated by tdd-UL-DL-ConfigurationCommon or tdd-UL-DL-ConfigurationDedicated if provided, or a symbol(s) of an SS/PBCH block with index provided by ssb-PositionsInBurst based on the procedures in Clause 11.1. A bit value of ‘0’ indicates that the UE may transmit CG-PUSCH, and a bit value of ‘1’ indicates that the UE will not transmit CG-PUSCH, in a corresponding CG-PUSCH TO. When the UE indicates by UTO-UCI a value of ‘1’ for a CG-PUSCH TO, the UE continues to indicate the value of ‘1’ for the CG-PUSCH TO by UTO-UCI multiplexed in subsequent CG-PUSCH transmissions, and the UE does not transmit CG-PUSCH in the CG-PUSCH TO. |

**Agreement**

Rel-18 multi-PUSCH CG is not supported for operation on shared spectrum.

* Capture the above in description of RAN1 higher layer parameter list for *nrofSlots\_InCGperiod*

**Agreement**

Adopt TP4-1 below for Clause 6.3.2.1.4 of 38.212:

|  |  |
| --- | --- |
| ***Reason for change:*** | The procedures in clause 6.3.2.1.4 for CG-UCI can be reused for UTO-UCI. However, the current specification does not clarify that the procedure is this clause is applicable when UTO-UCI and HARQ-ACK have the same priority and are jointly encoded. |
|  |  |
| ***Summary of change:*** | Clarify that the procedures in clause 6.3.2.1.4 are applicable when UTO-UCI and HARQ-ACK have the same priority and are jointly encoded.  |
|  |  |
| ***Consequences if not approved:*** | Inconsistent and ambiguous UE behaviour |
| 6.3.2.1.4 HARQ-ACK and CG-UCI/UTO-UCIIf 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 have the same priority index and are jointly encoded and transmitted on a PUSCH".\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchanged omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* |

**Agreement**

Adopt TP5-1 below for Clause 6.3.2.4.1 of 38.212:

|  |  |
| --- | --- |
| ***Reason for change:*** | The maximum length of UTO-UCI bit sequence is 8, which is not larger than 11. Hence, polar code is not applicable to UTO-UCI when it is not jointly encoded with HARQ-ACK. However, when UTO-UCI is jointly encoded with HARQ-ACK, depending on the size of HARQ-ACK code book, the UTO-UCI and HARQ-ACK sequences together may result in a code book with a size larger than 11 bits. In this case Polar codes should be applied for encoding. Currently, joint encoding of UTO-UCI and HARQ-ACK with Polar code is missing from the specification.  |
|  |  |
| ***Summary of change:*** | Include joint encoding of UTO-UCI and HARQ-ACK with Polar code when applicable. |
|  |  |
| ***Consequences if not approved:*** | Unspecified UE behaviour for jointly encoding UTO-UCI and HARQ-ACK with more than 11 bits. |
|  |  |
| 6.3.2.4.1 UCI encoded by Polar codeIf the higher layer parameter *nrof\_UTO\_UCI* is configured, the procedures in this clause and the clauses it refers to apply by replacing CG-UCI with UTO-UCI in all the notations and texts, when applicable.6.3.2.4.1.1 HARQ-ACKFor HARQ-ACK transmission on PUSCH not using repetition type B with UL-SCH and if *numberOfSlotsTBoMS* is not present in the resource allocation table, or if *numberOfSlotsTBoMS* is present in the resource allocation table and the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI is equal to 1, the number of coded modulation symbols per layer for HARQ-ACK transmission, denoted as , is determined as follows:\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchanged omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* |

**Agreement**

Adopt TP3-1 below for Clause 6.3.2.1.3A of 38.212:

|  |  |
| --- | --- |
| ***Reason for change:*** | In TS 38.212, 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, 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. |
|  |  |
| ***Consequences if not approved:*** | The references in specifications are unclear |
| 6.3.2.1.3A UTO-UCIFor UTO-UCI bits transmitted on a CG PUSCH when the higher layer parameter *nrof\_UTO\_UCI* is configured, the UTO-UCI bit sequence $a\_{0}, a\_{1}, a\_{2}, a\_{3}, …,a\_{A-1} $ is determined as follows:- set $a\_{i}=\tilde{o}\_{i}^{UTO-UCI}$ for $i=0,1, …, O^{UTO-UCI}-1$ and $A=O^{UTO-UCI}$, where $O^{UTO-UCI}$ is provided by *nrof\_UTO\_UCI*, and the UTO-UCI bit sequence $\tilde{o}\_{0}^{UTO-UCI}, \tilde{o}\_{1}^{UTO-UCI}, …, \tilde{o}\_{O^{UTO-UCI}-1}^{UTO-UCI}$ is given by clause ~~x.x~~9.3.1 of [5, TS 38.213].\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchnaged text omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*6.3.2.1.5 UCI with different priority indexesIf 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 ~~x.x~~9.3.1 of [5, TS 38.213]". \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchnaged text omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* |

**Agreement**

Adopt TP4-2 below for Clause 6.3.2.7 of 38.212:

|  |  |  |
| --- | --- | --- |
| ***Reason for change:*** | The procedures in clause 6.3.2.7 for CG-UCI can be reused for UTO-UCI. However, the following highlighted case described in this clause is not applicable to UTO-UCI since UTO-UCI has the same priority as the CG-PUSCH that is multiplexed in:

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| --- |
| If uci-MuxWithDiffPrio is configured, and HARQ-ACK bits associated with priority index 0, HARQ-ACK bits associated with priority index 1 and/or CG-UCI associated with priority index 1, and CSI part 1 if any are transmitted on a PUSCH,-    if CSI part 1 is also transmitted on the PUSCH and the PUSCH is associated with priority index 1, the coded UCI bits are multiplexed onto PUSCH according to the procedures in Clause 6.2.7 by taking HARQ-ACK with priority index 1 as HARQ-ACK, and taking HARQ-ACK with priority index 0 as CSI part 2;- otherwise, the coded UCI bits are multiplexed onto PUSCH according to the procedures in Clause 6.2.7 by taking HARQ-ACK with priority index 1 if any as HARQ-ACK, taking CG-UCI associated with priority index 1 if any as CG-UCI, taking HARQ-ACK with priority index 0 as CSI part 1, and taking CSI part 1 as CSI part 2 if CSI part 1 is also transmitted on the PUSCH and the PUSCH is associated with priority index 0. |

The inconsistency can be resolved by considering applicable cases for UTO-UCI when the corresponding CG-UCI procedures can be reused. |
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| ***Summary of change:*** | Add “when applicable” to the condition to resue the CG-UCI procedures for UTO-UCI. |
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| ***Consequences if not approved:*** | Inconsistent and ambiguous UE behaviour |
| 6.3.2.7 Multiplexing of coded UCI bits with different priority indexes to PUSCHIf the higher layer parameter *nrof\_UTO\_UCI* is configured, the procedure in this clause 6.3.2.7 applies by replacing CG-UCI with UTO-UCI in all the notations and texts, when applicable.\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* unchnaged text omitted \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* |