**3GPP TSG RAN WG1 #101 R1-200xxxx**

**e-Meeting, May 25th – June 5th, 2020**

Source: moderator (vivo)

Title: Feature lead summary on NRU configured grant enhancement

Agenda Item: 7.2.2.2.4

Document for: Discussion and Decision

1. Introduction

In this contribution, contributions submitted in AI 7.2.2.2.4 are summarized. In section 2, the remaining issues raised in the contributions are listed.

1. Remaining issues
	1. Issue 1: on CG repetition

TP#1

--------------Alt 1 TP for 38.214 6.1.2.3.1----------------------------------------------------------------------------------

<unchanged part omitted>

The 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-1,4)+1)th* value in the configured RV sequence. If a configured grant configuration is configured with *Configuredgrantconfig-StartingfromRV0* set to *‘off’*, the initial transmission of a transport block may only start at the first transmission occasion of the *K* repetitions.

<unchanged part omitted>

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Or

--------------Alt 2 TP for 38.214 6.1.2.3.1----------------------------------------------------------------------------------

<unchanged part omitted>

The 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, except for the redundancy version of the first repetition that is set to 0 when *repK* is not provided. 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-1,4)+1)th* value in the configured RV sequence. If a configured grant configuration is configured with *Configuredgrantconfig-StartingfromRV0* set to *‘off’*, the initial transmission of a transport block may only start at the first transmission occasion of the *K* repetitions.

<unchanged part omitted>

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Or

-----------------------------------TP2: Start of TP 38.214 section 6.1.2.3.1------------------------------------

6.1.2.3.1 Transport Block repetition for uplink transmissions of PUSCH repetition Type A with a configured grant

The 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, and if repK=1, the redundancy version for uplink retransmission with a configured grant is determined by the UE.~~, [except for the redundancy version of the first repetition that is set to 0]~~ If repK>1, the redundancy version is determined by the UE and for at least one repetition of up to repK repetitions is set to 0. 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-1,4)+1)th* value in the configured RV sequence. If a configured grant configuration is configured with *Configuredgrantconfig-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*.

<Unchanged parts are omitted>

----------------------------------------End of TP 38.214 section 6.1.2.3.1------------------------------------------

TP#2

-----------------------------------TP1: Start of TP 38.214 section 6.1.2.3.1------------------------------------

6.1.2.3.1 Transport Block repetition for uplink transmissions of PUSCH repetition Type A with a configured grant

<Unchanged parts are omitted>

For both Type 1 and Type 2 PUSCH transmissions with a configured grant, when *K >* 1*,* the UE shall repeat the TB across the *K* consecutive slots applying the same symbol allocation in each slot, except if the UE is provided with higher layer parameters *cg-nrofSlots-r16* and *cg-nrofPUSCH-InSlot-r16*, in which case the UE may repeat~~s~~ the TB in up to the *repK* earliest consecutive transmission occasion candidates within the same configuration from any transmission occasion for which the related channel procedure described in 37.213 is successful. A Type 1 or Type 2 PUSCH transmission with a configured grant in a slot is omitted according to the conditions in Clause 11.1 of [6, TS38.213].

<Unchanged parts are omitted>

----------------------------------------End of TP 38.214 section 6.1.2.3.1------------------------------------------

TP#3

-----------------------------------------------< BEGIN TEXT PROPOSAL >-------------------------------------------------

6.1.2.3.1 Transport Block repetition for uplink transmissions of PUSCH repetition Type A with a configured grant

\*\*\* Unchanged text is omitted \*\*\*

For both Type 1 and Type 2 PUSCH transmissions with a configured grant, when the UE is configured with *repK >* 1*,* the UE shall repeat the TB across the *repK* consecutive slots applying the same symbol allocation in each slot, except if the UE is provided with higher layer parameters *cg-nrofSlots-r16* and *cg-nrofPUSCH-InSlot-r16*, in which case the UE repeats the TB in the *repK* earliest consecutive transmission occasion candidates within the same configuration. For operation with shared spectrum channel access, where the UE is provided with higher layer parameters *cg-nrofSlots-r16* and *cg-nrofPUSCH-InSlot-r16*  and *repK>1,* the UE shall perform the transmission of the first repetition in the earliest transmission occasion for which the related channel access procedure described in 37.213 is successful.A Type 1 or Type 2 PUSCH transmission with a configured grant in a slot is omitted according to the conditions in Subclause 11.1 of [6, TS38.213].

\*\*\* Unchanged text is omitted \*\*\*

-----------------------------------------------< END TEXT PROPOSAL >-------------------------------------------------

Or

**---------------------------------------------- TP1: TS 38.214 section 6.1.2.3.1---------------------------------------------**

\*\*\* Unchanged text is omitted \*\*\*

6.1.2.3.1 Transport Block repetition for uplink transmissions with a configured grant

\*\*\* Unchanged text is omitted \*\*\*

For both Type 1 and Type 2 PUSCH transmissions with a configured grant, when K > 1, the UE shall repeat the TB across the K consecutive slots applying the same symbol allocation in each slot, except if the UE is provided with higher layer parameters cg-nrofSlots-r16 and cg-nrofPUSCH-InSlot-r16, in which case the UE repeats the TB in the repK earliest consecutive transmission occasion candidates within the same configuration. For operation with shared spectrum channel access, if the UE is provided with higher layer parameters *cg-nrofSlots-r16* and *cg-nrofPUSCH-InSlot-r16*  and *repK>1,* the UE shall postpone the transmission burst to the earliest transmission occasion for which the related channel procedure described in 37.213 is successful.A Type 1 or Type 2 PUSCH transmission with a configured grant in a slot is omitted according to the conditions in Clause 11.1 of [6, TS38.213].

\*\*\* Unchanged text is omitted \*\*\*

**---------------------------------------------- End---------------------------------------------**

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* 1. Issue 2: values range of cg-COT-sharinglist

***Proposal 1：Considering MCOT=10ms for p=3 and p=4, i.e.,*** $N\_{p,μ}$*=40* ***slots for*** *μ=2*, ***and accounting for the maximum number of (O, D) combination per CAP as*** $\frac{\left(N\_{p,μ}-1\right)N\_{p,μ}}{2}$***, the value range for the parameter cg-COT-SharingList-r16 should be changed as follows:***

* cg-COT-SharingList-r16 SEQUENCE (SIZE (1..1709)) OF CG-COT-Sharing-r16

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* 1. Issue 3: maximum number of PUSCH in a slot

***Proposal 3: The maximum configurable value for cg-nrofPUSCH-InSlot-r16 can be set as 7.***

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* 1. Issue 4: dynamic indication of beta offset

**The beta-offset values used for CG-UCI can be configured as dynamic**

(there are 2 tdocs proposing slightly different TPs in [R1-2003373](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003373.zip), [R1-2003453](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003453.zip))

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* 1. Issue 5: on COT sharing information restriction

-----------------------------------TP3: Start of TP 38.212 section 6.3.2.1.3------------------------------------

6.3.2.1.3 CG-UCI

For CG-UCI bits transmitted on a CG PUSCH, the CG-UCI bit sequence $a\_{0}, a\_{1}, a\_{2}, a\_{3}, …,a\_{A-1} $ is determined as follows:

- set $a\_{i}=\tilde{o}\_{i}^{CG-UCI}$ for $i=0,1, …, O^{CG-UCI}-1$ and $A=O^{CG-UCI}$, where the CG-UCI bit sequence $\tilde{o}\_{0}^{CG-UCI}, \tilde{o}\_{1}^{CG-UCI}, …, \tilde{o}\_{O^{CG-UCI}-1}^{CG-UCI}$ is given by Table 6.3.2.1.3-1, mapped in the order from upper part to lower part.

Table 6.3.2.1.3-1: Mapping order of CG-UCI fields

|  |  |
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| **Field** | **Bitwidth** |
| HARQ process number | 4 |
| Redundancy version | 2 |
| New data indicator | 1 |
| Channel Occupancy Time (COT) sharing information | $\left⌈log\_{2}C\right⌉$ if both higher layer parameter *ULtoDL-CO-SharingED-Threshold-r16* and higher layer parameter *cg-COT-SharingList-r16* are configured and is not configured with *ChannelAccessMode-r16* =' *semistatic'*, where *C* is the number of combinations configured in *cg-COT-SharingList-r16;* 1 if higher layer parameter *ULtoDL-CO-SharingED-Threshold-r16* is not configured and higher layer parameter *cg-COT-SharingOffset-r16* is configured and is not configured with *ChannelAccessMode-r16* =' *semistatic'*;0 otherwise; |

----------------------------------------End of TP 38.212 section 6.3.2.1.3------------------------------------------

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* 1. Issue 6: COT sharing related
* ***it is necessary to clarify if the COT sharing information can be updated by subsequent CG-UCI.***
* ***the gap should be ensured by UE if the CG-UCI indicates that the COT sharing information available, otherwise, the COT sharing information should be indicated as not available.***
* The CG-UCI indication carried by different PUSCHs indicates the COT sharing information independently, which means COT sharing information carried in later CG-PUSCH will not override the information in the earlier ones.

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* 1. Issue 7: CG-UCI multiplexing on multiple PUSCH

---------------------------------------- TP4: Start of TP 38.213 section 9.0 ---------------------------------------------

9 UE procedure for reporting control information

<Unchanged parts are omitted>

If a UE transmits multiple PUSCHs in a slot on respective serving cells that include first PUSCHs that are scheduled by DCI formats and second PUSCHs configured by respective *ConfiguredGrantConfig* or *semiPersistentOnPUSCH*, and the UE would multiplex UCI in one of the multiple PUSCHs, and the multiple PUSCHs fulfil the conditions in Clause 9.2.5 for UCI multiplexing, the UE multiplexes the UCI in a PUSCH from the first PUSCHs.

For operation with shared channel access, if a UE transmits multiple PUSCHs in a slot configured by *ConfiguredGrantConfig* on respective serving cells and the UE would multiplex UCI in one of the multiple PUSCHs, and the multiple PUSCHs fulfil the conditions in Subclause 9.2.5 for UCI multiplexing, the UE multiplexes the UCI in a PUSCH from the last PUSCHs.

<Unchanged parts are omitted>

----------------------------------------End of TP 38.213 section 9.0 ---------------------------------------------

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* 1. Issue 8: HARQ-ACK for CBG based PUSCH

TP#1

================= Start of TP#1 for TS 38.213 ====================

10.5 HARQ-ACK information for PUSCH transmissions

< Unchanged Texts Omitted >

For a PUSCH transmission scheduled by a DCI format, if a UE is provided *PUSCH-CodeBlockGroupTransmission* for a serving cell, a value of HARQ-ACK information for a transport block of a corresponding HARQ process number is ACK if at least one of CBGs for the PUSCH is ACK; otherwise, a value of HARQ-ACK information is NACK

For a PUSCH transmission configured by *ConfiguredGrantConfig*, if a UE is provided *PUSCH-CodeBlockGroupTransmission* for a serving cell, a value of HARQ-ACK information for a transport block of a corresponding HARQ process number is ACK if all of CBGs for the PUSCH are ACK; otherwise, a value of HARQ-ACK information is NACK.

For a PUSCH transmission scheduled by a DCI format, HARQ-ACK information for a transport block of a corresponding HARQ process number is valid if a first symbol of the PDCCH reception is after a last symbol of the PUSCH transmission or, if the PUSCH transmission is over multiple slots,

- after a last symbol of the PUSCH transmission in a first slot from the multiple slots by a number of symbols provided by *cg-minDFIDelay-r16*, if a value of the HARQ-ACK information is ACK.

- after a last symbol of the PUSCH transmission in a last slot from the multiple slots by a number of symbols provided by *cg-minDFIDelay-r16*, if a value of the HARQ-ACK information is NACK.

< Unchanged Texts Omitted >

========================== End of TP#1 for TS 38.213 =========================

TP#2

=================== Start of TP for TS 38.213 =======================

10.5 HARQ-ACK information for PUSCH transmissions

< Unchanged Texts Omitted >

For a PUSCH transmission scheduled by a DCI format, if a UE is provided *PUSCH-CodeBlockGroupTransmission* for a serving cell, a value of HARQ-ACK information for a transport block of a corresponding HARQ process number is ACK if all of CBGs for the PUSCH are ACK; otherwise, a value of HARQ-ACK information is NACK.

For a PUSCH transmission scheduled by a DCI format, HARQ-ACK information for a transport block of a corresponding HARQ process number is valid if a first symbol of the PDCCH reception is after a last symbol of the PUSCH transmission or, if the PUSCH transmission is over multiple slots,

- after a last symbol of the PUSCH transmission in a first slot from the multiple slots by a number of symbols provided by *cg-minDFIDelay-r16*, if a value of the HARQ-ACK information is ACK.

- after a last symbol of the PUSCH transmission in a last slot from the multiple slots by a number of symbols provided by *cg-minDFIDelay-r16*, if a value of the HARQ-ACK information is NACK.

< Unchanged Texts Omitted >

================ End of TP for TS 38.213 ==========================

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* 1. Issue 9: DFI related

TP for monitoring when SUL is configured

======================== Start of TP#2 for TS 38.212 =========================

7.3.1.1.2 Format 0\_1

< Unchanged Texts Omitted >

DCI format 0\_1 is used for the scheduling of one or multiple PUSCH in one cell, or indicating CG downlink feedback informatin (CG-DFI) to a UE.

The following information is transmitted by means of the DCI format 0\_1 with CRC scrambled by C-RNTI or CS-RNTI or SP-CSI-RNTI or MCS-C-RNTI:

- Identifier for DCI formats – 1 bit

- The value of this bit field is always set to 0, indicating an UL DCI format

- Carrier indicator – 0 or 3 bits, as defined in Clause 10.1 of [5, TS38.213].

- DFI flag – 0 or 1 bit

- 1 bit if the UE is configured to monitor DCI format 0\_1 with CRC scrambled by CS-RNTI and for operation in a cell with shared spectrum channel access, where the UE is not configured with *supplementaryUplink* in *ServingCellConfig* for the cell or configured with *supplementaryUplink* in *ServingCellConfig* for the cell and UL carrier is configured for PUSCH transmission. For a DCI format 0\_1 with CRC scrambled by CS-RNTI, the bit value of 0 indicates activating type 2 CG transmission and the bit value of 1 indicates CG-DFI. For a DCI format 0\_1 with CRC scrambled by C-RNTI/SP-CSI-RNTI/MCS-C-RNTI, the bit is reserved.

- 0 bit otherwise;

< Unchanged Texts Omitted >

======================= End of TP#2 for TS 38.212 =========================

Proposal on DCI format 0\_2

* Proposal #4: Consider to use DCI format 0\_2 for indicating CG downlink feedback information to a UE.

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* 1. Issue 10: on cg-RetransmissionTimer
1. Send an LS to RAN2 asking for not mandating configuration of (cg-RetransmissionTimer) when configured grant Type 1 and Type 2 are configured on unlicensed spectrum.
2. DFI flag in DCI 0\_1 is not present if the higher layer parameter (cg-RetransmissionTimer) is not configured
3. The UE is expected to send CG-UCI in every PUSCH only when the higher layer parameter (cg-RetransmissionTimer) is configured
4. Support new UE capability in which the UE indicates the support of cg-RetransmissionTimer.

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* 1. Issue 11: Validation of Type 2 CG scheduling release

***Proposal 2：For the validation of scheduling release of single or multiple Type 2 CG(s) configured with Type 2 FDRA with µ=1, it should be discussed whether the FDRA filed indicates “all 1’s” along with the invalid indication in the MCS field similar to the case with Type 0 FDRA as per the URLLC agreement for eCG.***

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* 1. Issue 12: UE-ID in CG-UCI

**Proposal 2: The UE-ID is explicitly indicated within the CG-UCI upon RRC configuration.**

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* 1. Issue 13: Editorial

38.214

6.1 UE procedure for transmitting the physical uplink shared channel

< Unchanged parts are omitted >

For the licensed spectrum, a UE is not expected to be scheduled by a PDCCH ending in symbol $i$ to transmit a PUSCH on a given serving cell for a given HARQ process, if there is a transmission occasion where the UE is

< End of text proposal >

or

<Unchanged part omitted>

Except for operation with shared spectrum channel access, a ~~A~~ UE is not expected to be scheduled by a PDCCH

< End of text proposal >

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# References

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| --- | --- | --- |
| [R1-2003373](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003373.zip) | Remaining issues on the enhancements to configured grant | vivo |
| [R1-2003453](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003453.zip) | Remaining issues on the configured grant for NR-U | ZTE, Sanechips |
| [R1-2003515](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003515.zip) | Maintenance on the configured grant procedures | Huawei, HiSilicon |
| [R1-2003731](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003731.zip) | Enhancements to configured grants for NR-unlicensed | Intel Corporation |
| [R1-2003824](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003824.zip) | Text proposals for configured grant enhancement for NR-U | Lenovo, Motorola Mobility |
| [R1-2003846](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003846.zip) | Configured grant enhancement | Ericsson |
| [R1-2003863](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003863.zip) | Configured grant enhancement for NR-U | Samsung |
| [R1-2004016](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2004016.zip) | Remaining issues of configured grant for NR-U | LG Electronics |
| [R1-2004088](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2004088.zip) | Discussion on the remaining issues of configured grant enhancements | OPPO |
| [R1-2004446](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2004446.zip) | TP for Enhancements to configured grants for NR-U | Qualcomm Incorporated |