**3GPP TSG RAN WG1 #100bis R1-20xxxxx**

**e-Meeting, April 20th – 30th, 2020**

Title: Summary of enhanced UL configured grant transmission for URLLC

Source: Moderator (vivo)

Agenda Item: 7.2.5.6

**Document for:** **Discussion and Decision**

# **Introduction**

Based on the phase 1 discussions and suggestions, Chairman allocates following two email discussions for eCG for URLLC. In this document, [100b-e-NR-L1enh\_URLLC-eCG-01] will be the focus. **It is noted that the deadline for agreements/conclusions is 4/24, and the deadline for the corresponding TP is by 4/29**.

* [100b-e-NR-L1enh-URLLC-eCG-01] Email discussion/approval regarding DMRS and PTRS operation for dynamic PUSCH and configured grant PUSCH (section 3.1.1. 3.1.2 and 3.1.3 in [R1-2001796](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_100b\Docs\R1-2001796.zip)) till 4/24, and potential TPs for approval by 4/29 (vivo, Lihui)
* [100b-e-NR-L1enh-URLLC-eCG-02] Email discussion/approval regarding corrections as in section 3.2.1, 3.2.2 and 4.1 in [R1-2001796](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_100b\Docs\R1-2001796.zip) till 4/24, and potential TPs for approval by 4/29 (vivo, Lihui)

# **Necessary Corrections**

# **Type 2 CG/SPS activation/release validation**

* **Issue 1:** [R1-2001698, R1-2001699, Nokia] identified following issues
  + The overlapping decision made by the NR-U that specifically focusing on the new FDRA Type 2 results in a different behavior for FDRA Type 0 & 1 for Type 2 CG release as agreed by the URLLC enhancements. Therefore, corresponding corrections are proposed.
  + Clarify the applicable FDRA validation for SPS release for ‘dynamicSwitch’ in Sec. 10.2 of TS 38.213.
* **Issue 2:** [R1-2001674, vivo] proposed to clear the title for Table 10.2-1 ~ Table 10.2-3 for Type 2CG and SPS activation and release PDCCH validation since current table title may cause confusion on which table should be used when a UE is provided a single configuration and when a UE is provided more than one configuration. For example, the title for Table 10.2-2 is “Special fields for single DL SPS or single UL grant Type 2 scheduling release PDCCH validation”, it seems the Table 10.2-2 can also be used as separate release in case a UE is provided more than one configuration. However, the intention is the Table 10.2-2 is only used for the case of a UE provided a single configuration. Therefore, corresponding corrections are proposed.

In addition, [R1-2002412, ITRI] also proposed some editorial corrections. Therefore, following TP is proposed:

* **TP version 1: adopt following TP in Sec. 10.2 of TS 38.213**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 10.2 PDCCH validation for DL SPS and UL grant Type 2 < Unchanged parts are omitted >  If a UE is provided a single configuration for UL grant Type 2 PUSCH or for SPS PDSCH, validation of the DCI format is achieved if all fields for the DCI format are set according to Table 10.2-1 or Table 10.2-2.  If a UE is provided more than one configurations for UL grant Type 2 PUSCH or for SPS PDSCH, a value of the HARQ process number field in a DCI format indicates an activation for a corresponding UL grant Type 2 PUSCH or for a SPS PDSCH configuration with a same value as provided by *Configuredgrantconfig-index* or by *SPSconfig-index*, respectively. Validation of the DCI format is achieved if the RV field for the DCI format is set as in Table 10.2-3.  If a UE is provided more than one configurations for UL grant Type 2 PUSCH or for SPS PDSCH  - if the UE is provided *Type2Configuredgrantconfig-ReleaseStateList* or *SPS-ReleaseStateList*, a value of the HARQ process number field in a DCI format indicates a corresponding entry for scheduling release of one or more UL grant Type 2 PUSCH or SPS PDSCH configurations  - if the UE is not provided *Type2Configuredgrantconfig-ReleaseStateList* or *SPS-ReleaseStateList*, a value of the HARQ process number field in a DCI format indicates a release for a corresponding UL grant Type 2 PUSCH or for a SPS PDSCH configuration with a same value as provided by *Configuredgrantconfig-index* or by *SPSconfig-index*, respectively  Validation of the DCI format is achieved if all fields for the DCI format are set according to Table 10.2-4.  If validation is achieved, the UE considers the information in the DCI format as a valid activation or valid release of DL SPS or configured UL grant Type 2. If validation is not achieved, the UE discards all the information in the DCI format.  Table 10.2-1: Special fields for single DL SPS or single UL grant Type 2 scheduling activation PDCCH validation when a UE is provided a single SPS PDSCH or UL grant Type 2 configuration   |  |  |  |  | | --- | --- | --- | --- | |  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_2 | DCI format 1\_1 | | HARQ process number | set to all '0's~~/0\_2~~ | set to all '0's | set to all '0's | | Redundancy version | set to all '0's | set to all '0's | For the enabled transport block: set to all '0's |   Table 10.2-2: Special fields for single DL SPS or single UL grant Type 2 scheduling release PDCCH validation when a UE is provided a single SPS PDSCH or UL grant Type 2 configuration   |  |  |  | | --- | --- | --- | |  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_1/1\_2 | | HARQ process number | set to all '0's | set to all '0's | | Redundancy version | set to all '0's | set to all '0's | | Modulation and coding scheme | set to all '1's | set to all '1's | | Frequency domain resource assignment | set to all '0's ~~for FDRA Type 0 or~~ for FDRA Type 2 with ,  set to all '1's otherwise ~~for FDRA Type 1 or for FDRA Type 2 with~~ | set to all '0's for FDRA Type 0 or for ‘dynamicSwitch’  set to all '1's for FDRA Type 1 |   Table 10.2-3: Special fields for a single DL SPS or single UL grant Type 2 scheduling activation PDCCH validation when a UE is provided multiple DL SPS or UL grant Type 2 configurations   |  |  |  |  | | --- | --- | --- | --- | |  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_2 | DCI format 1\_1 | | Redundancy version | set to all '0's | set to all '0's | For the enabled transport block: set to all '0's |   Table 10.2-4: Special fields for a single or multiple DL SPS and UL grant Type 2 scheduling release PDCCH validation when a UE is provided multiple DL SPS or UL grant Type 2 configurations   |  |  |  | | --- | --- | --- | |  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_1/1\_2 | | Redundancy version | set to all '0's | set to all '0's | | Modulation and coding scheme | set to all '1's | set to all '1's | | Frequency domain resource assignment | set to all '0's ~~for FDRA Type 0 or~~ for FDRA Type 2 with ,  set to all '1's otherwise ~~for FDRA Type 1 or for FDRA Type 2 with~~ | set to all '0's for FDRA Type 0 or for ‘dynamicSwitch’  set to all '1's for FDRA Type 1 |   < Unchanged parts are omitted > |

Alternatively, based on the email discussion during the preparation phase, Huawei commented that according to the conclusion made for FDRA field setting for CG release validation, it is no problem to always set the FDRA field to “1s” irrespective of the FDRA type in the release DCI. Because the 5-bits MCS field in this case can be used to differentiate the activation and the release PDCCH. Therefore, further optimization for SPS release validation is not needed and proposed following TP:

* **TP version 2: adopt following TP in Sec. 10.2 of TS 38.213**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 10.2 PDCCH validation for DL SPS and UL grant Type 2 < Unchanged parts are omitted >  If a UE is provided a single configuration for UL grant Type 2 PUSCH or for SPS PDSCH, validation of the DCI format is achieved if all fields for the DCI format are set according to Table 10.2-1 or Table 10.2-2.  If a UE is provided more than one configurations for UL grant Type 2 PUSCH or for SPS PDSCH, a value of the HARQ process number field in a DCI format indicates an activation for a corresponding UL grant Type 2 PUSCH or for a SPS PDSCH configuration with a same value as provided by *Configuredgrantconfig-index* or by *SPSconfig-index*, respectively. Validation of the DCI format is achieved if the RV field for the DCI format is set as in Table 10.2-3.  If a UE is provided more than one configurations for UL grant Type 2 PUSCH or for SPS PDSCH  - if the UE is provided *Type2Configuredgrantconfig-ReleaseStateList* or *SPS-ReleaseStateList*, a value of the HARQ process number field in a DCI format indicates a corresponding entry for scheduling release of one or more UL grant Type 2 PUSCH or SPS PDSCH configurations  - if the UE is not provided *Type2Configuredgrantconfig-ReleaseStateList* or *SPS-ReleaseStateList*, a value of the HARQ process number field in a DCI format indicates a release for a corresponding UL grant Type 2 PUSCH or for a SPS PDSCH configuration with a same value as provided by *Configuredgrantconfig-index* or by *SPSconfig-index*, respectively  Validation of the DCI format is achieved if all fields for the DCI format are set according to Table 10.2-4.  If validation is achieved, the UE considers the information in the DCI format as a valid activation or valid release of DL SPS or configured UL grant Type 2. If validation is not achieved, the UE discards all the information in the DCI format.  Table 10.2-1: Special fields for single DL SPS or single UL grant Type 2 scheduling activation PDCCH validation when a UE is provided a single SPS PDSCH or UL grant Type 2 configuration   |  |  |  |  | | --- | --- | --- | --- | |  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_2 | DCI format 1\_1 | | HARQ process number | set to all '0's~~/0\_2~~ | set to all '0's | set to all '0's | | Redundancy version | set to all '0's | set to all '0's | For the enabled transport block: set to all '0's |   Table 10.2-2: Special fields for single DL SPS or single UL grant Type 2 scheduling release PDCCH validation when a UE is provided a single SPS PDSCH or UL grant Type 2 configuration   |  |  |  | | --- | --- | --- | |  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_1/1\_2 | | HARQ process number | set to all '0's | set to all '0's | | Redundancy version | set to all '0's | set to all '0's | | Modulation and coding scheme | set to all '1's | set to all '1's | | Frequency domain resource assignment | set to all '0's ~~for FDRA Type 0 or~~ for FDRA Type 2 with ,  set to all '1's otherwise ~~for FDRA Type 1 or for FDRA Type 2 with~~ | ~~set to all '0's for FDRA Type 0~~  set to all '1's ~~for FDRA Type 1~~ |   Table 10.2-3: Special fields for a single DL SPS or single UL grant Type 2 scheduling activation PDCCH validation when a UE is provided multiple DL SPS or UL grant Type 2 configurations   |  |  |  |  | | --- | --- | --- | --- | |  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_2 | DCI format 1\_1 | | Redundancy version | set to all '0's | set to all '0's | For the enabled transport block: set to all '0's |   Table 10.2-4: Special fields for a single or multiple DL SPS and UL grant Type 2 scheduling release PDCCH validation when a UE is provided multiple DL SPS or UL grant Type 2 configurations   |  |  |  | | --- | --- | --- | |  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_1/1\_2 | | Redundancy version | set to all '0's | set to all '0's | | Modulation and coding scheme | set to all '1's | set to all '1's | | Frequency domain resource assignment | set to all '0's ~~for FDRA Type 0 or~~ for FDRA Type 2 with ,  set to all '1's otherwise ~~for FDRA Type 1 or for FDRA Type 2 with~~ | ~~set to all '0's for FDRA Type 0~~  set to all '1's ~~for FDRA Type 1~~ |   < Unchanged parts are omitted > |

Please share your **preference for TP version 1 or TP version 2**, and any other comments?

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| --- | --- |
| Company | View |
| Nokia, NSB | We would be fine with both versions in principle.  Maybe a slight preference for TP version 2, as then the operation of CG and SPS would be more aligned here |
| Samsung | We prefer TP version 1 since starting points of discussion for CG and SPS are different based TS 38.213 v16.0.0 as follows.   |  |  |  | | --- | --- | --- | | Frequency domain resource assignment | set to all '1's | set to all '0's for FDRA Type 0  set to all '1's for FDRA Type 1 |   For CG, main issue was whether or not consider optimization and the conclusion was that we keep as current specification. On the other hand, for SPS, there were different FDRA field depending on FDRA configuration. So, we don’t need to step back with allowing less optimization than existing specification. It is noted that aligning FDRA field between CG and SPS is just something like “looks good” or “nice to have” in specification. |
| Panasonic | Either TP version can work. As it is possible to be distinguished by MCS field, our slight preference is TP version 2. |
| LG | We are fine with the proposal. Between TP 1 and 2, we slightly prefer to TP version 1. |
| CATT | We are fine with TP version 1 and for SPS we are the same view with Samsung and prefer to keep current spec and dynamic switch case needn’t be addressed. |
| QC | We support TP1. It was already discussed and agreed how FDRA bitfields can be set for SPS release and no need to change it. We should note that SPS is different from Type2 CG configuration from the perspective of RA Type configuration; where RA Type is defined per CG configuration while this is not the case for SPS. |
| MediaTek | We are fine with both TPs. |
| Huawei, HiSilicon | We support TP version 2. The reasons are as follows:   1. It covers all the cases including *resourceAllocationType0*, *resourceAllocationType1* and *dynamicSwitch.* 2. It works well for SPS release validation, as the 5-bit MCS field is enough to distinguish the DCI for activation and the DCI for release. 3. It simplifies UE behaviour, as the UE does not need to determine the FDRA field value according the RA type. 4. It keeps a unified solution for Type 2 CG and DL SPS.   In addition, there is not any essential difference between Type 2 CG and DL SPS that really matters and requires different treatments for the same purpose. |
| ZTE | We slightly prefer TP1. |
| Intel | Fine with either version, but slightly prefer TP2 version. |
| vivo | Fine with both TPs, but slightly prefer TP1, share the views with Samsung. |
| OPPO | Fine with both TPs, but slightly prefer TP1, share the views with Samsung. |
| Ericsson | We prefer TP version 2.  TP version 1 is also acceptable if “or for ‘dynamicSwitch’” is deleted. We do not see any reason to address this in SPS validation. |
| ITRI | Fine with both TPs, but slightly prefer TP version 2. |

Observation: Both TP version can work well.

* Support TP version 1 (11): Nokia (2ed preference), Samsung, Panasonic (2ed preference), LG (1st preference), CATT, QC, MTK, ZTE, Intel (2ed preference), vivo (1st preference),OPPO (1st preference), ITRI (2nd preference)
* Support TP version 2 (11): Nokia (1st preference), Panasonic (1st preference), LG (2ed preference), MTK, Huawei, HiSilicon, Intel (1st preference), vivo (2ed preference),OPPO(2nd preference), Ericsson (1st preference), ITRI (1st preference)

# **Clarify the inapplicability of priority indication by DCI for SPS and CG**

* **Issue:** [R1-2001789, Ericsson], [R1-2001698, Nokia] and [R1-2002447, DCM] proposed following TPs in 38.213 to clarify that the priority indication by DCI does not apply for uplink configured grant transmission and HARQ-ACK feedback for downlink SPS:
* **FL suggestion adopt following TP in TS 38.213.**

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| 9 UE procedure for reporting control information  <Unchanged text is omitted>  A PUSCH or a PUCCH, including repetitions if any, can be of priority index 0 or of priority index 1. If a priority index is not provided for a PUSCH or a PUCCH, the priority index is 0. For a configured grant PUSCH the priority index is determined based on the higher layer parameter *priority*, if provided. The priority of a PUCCH carrying HARQ-ACK feedback corresponding to SPS PDSCH reception or SPS PDSCH release is determined based on higher layer parameter *harq-CodebookID*, if provided. If in an active DL BWP a UE monitors PDCCH either for detection of DCI format 0\_1 and DCI format 1\_1 or for detection of DCI format 0\_2 and DCI format 1\_2, a priority index can be provided by a priority indicator field. If a UE indicates a capability to monitor, in an active DL BWP, PDCCH for detection of DCI format 0\_1 and DCI format 1\_1 and for detection of DCI format 0\_2 and DCI format 1\_2, a DCI format 0\_1 or a DCI format 0\_2 can schedule a PUSCH transmission of any priority and a DCI format 1\_1 or a DCI format 1\_2 can schedule a PDSCH reception and trigger a PUCCH transmission with corresponding HARQ-ACK information of any priority.  **<**Unchanged text is omitted> |

Any comments?

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| Company | View |
| Nokia, NSB | We would be fine with the TP above. |
| Samsung | We are fine with TP |
| Panasonic | We agree to the TP. |
| LG | We are fine with the suggestion. |
| CATT | We are fine with proposed TP. |
| QC | Agree with TP. |
| MediaTek | We are fine with proposed TP. |
| Huawei, HiSilicon | We are fine with the TP. |
| ZTE | We are fine with the TP. |
| Intel | Agree |
| vivo | Support with the TP. |
| Apple | Fine with the TP |
| OPPO | Fine with the TP |
| Ericsson | Support the TP |
| ITRI | Fine with this TP |

# **Priority configuration for multiple SPS configurations to be released by a single PDCCH**

In addition, [R1-2002447, DCM] proposed following TP to clarify the relations between the priority index in DCI and *harq-CodebookID*.

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| 9.1 HARQ-ACK codebook determination  If a UE is provided *pdsch-HARQ-ACK-Codebook-*List, the UE can be indicated by *pdsch-HARQ-ACK-Codebook-List* to generate one or two HARQ-ACK codebooks. If the UE is indicated to generate two HARQ-ACK codebooks  - a first HARQ-ACK codebook is associated with a PUCCH of priority index 0 and a second HARQ-ACK codebook is associated with a PUCCH of priority index 1  - the UE is provided first and second for each of {*PUCCH-Config*, *UCI-OnPUSCH*, *PDSCH*-*codeBlockGroupTransmission*} by {*PUCCHConfigurationList*, *UCI-OnPUSCH-List*, *PDSCH-CodeBlockGroupTransmission-List*}, respectively, for use with the first and second HARQ-ACK codebooks, respectively  If a UE receives a PDSCH without receiving a corresponding PDCCH, or if the UE receives a PDCCH indicating a SPS PDSCH release, the UE generates one corresponding HARQ-ACK information bit. If the UE generates two HARQ-ACK codebooks, the UE is indicated by *harq-CodebookID*, per SPS PDSCH configuration, a HARQ-ACK codebook index for multiplexing the corresponding HARQ-ACK information bit with same priority. The priority index is 0 for HARQ-ACK for SPS PDSCH or a SPS PDSCH release if the associated HARQ-ACK codebook configured with the *harq-CodebookID* value 1. The priority index is 1 for HARQ-ACK for SPS PDSCH or a SPS PDSCH release if the associated HARQ-ACK codebook configured with the *harq-CodebookID* value 2. UE doesn’t expect a multiple SPS PDSCH release by a single DCI format to release multiple SPS configuration with different *harq-CodebookID* values.  […] |

From FL perspective, the priority index in SPS activation DCI is not used to determine the priority for HARQ-ACK for corresponding SPS. Therefore, it is not necessary to clarify it. Instead, multiple SPS configurations to be released by the joint release DCI should have the same priority should be captured in the spec.

* **FL suggestion adopt following TP in TS 38.213.**

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| 9.1 HARQ-ACK codebook determination  If a UE is provided *pdsch-HARQ-ACK-Codebook-*List, the UE can be indicated by *pdsch-HARQ-ACK-Codebook-List* to generate one or two HARQ-ACK codebooks. If the UE is indicated to generate two HARQ-ACK codebooks  - a first HARQ-ACK codebook is associated with a PUCCH of priority index 0 and a second HARQ-ACK codebook is associated with a PUCCH of priority index 1  - the UE is provided first and second for each of {*PUCCH-Config*, *UCI-OnPUSCH*, *PDSCH*-*codeBlockGroupTransmission*} by {*PUCCHConfigurationList*, *UCI-OnPUSCH-List*, *PDSCH-CodeBlockGroupTransmission-List*}, respectively, for use with the first and second HARQ-ACK codebooks, respectively  If a UE receives a PDSCH without receiving a corresponding PDCCH, or if the UE receives a PDCCH indicating a SPS PDSCH release, the UE generates one corresponding HARQ-ACK information bit. If the UE generates two HARQ-ACK codebooks, the UE is indicated by *harq-CodebookID*, per SPS PDSCH configuration, a HARQ-ACK codebook index for multiplexing the corresponding HARQ-ACK information bit. A UE doesn’t expect to be indicated to release multiple SPS PDSCH with different *harq-CodebookID* values by a single DCI format.  […] |

Any comments for above TP?

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| Company | View |
| Nokia, NSB | Fine with the intention of the TP, but there is no need to configure harq-CodebookID for low priority (i.e. RRC parameter optional)? So this case may need to be covered as well… |
| Samsung | We are not supportive of TP. This is up to gNB implementation issue and it could be considered in RRC specification in the case of misconfiguration. |
| Panasonic | We are OK with FL suggestion. |
| LG | We are fine with the suggestion. |
| CATT | We are fine with FL proposal |
| QC | We support FL TP, and better to be captured in RAN1 spec too. |
| MediaTek | We support the proposed TP. |
| Intel | Prefer to define it in one place. Since RRC handles it, may be no need to update RAN1 spec. |
| Apple | Fine with the proposed TP |
| OPPO | Fine with the FL proposal |
| Ericsson | As pointed out below, no TP is necessary in RAN1 spec, since 38.331 covers the same already. |
| ITRI | Fine with this TP |

Regarding the above proposed TP for priority configuration for multiple SPS configurations to be released by a single PDCCH, since it is already captured in the endorsed RAN2 TS 38.331 (R2-2002359), see below. Therefore, the TP seems not necessary.

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| ***SPS-ConfigList field descriptions*** |
| ***sps-ConfigDeactivationStateList***  Indicates a list of the deactivation states in which each state can be mapped to a single or multiple SPS configurations to be deactivated, see clause 10.2 in TS 38.213 [13] . If a state is mapped to multiple SPS configurations, each of these SPS configurations is configured with the same *harq-CodebookID*. |

Any comments?

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| Company | View |
| Nokia, NSB | As this is captured in RRC specs already, then maybe no need to have this here. So we would be fine to close 2.3 here (i.e. no TP needed). |
| ZTE | Agree that no TP is needed in RAN1 since it is already in RAN2 spec. |
| vivo | Agree that no TP is needed in RAN1 since it is already in RAN2 spec. |

# **Flexible initial transmission occasion(s) for CG**

* **Issue:**

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| In Rel. 16, the initial transmission occasion(s) for a CG as defined in 38.214 section 6.1.2.3 as below: 6.1.2.3.1 Transport Block repetition for uplink transmissions of PUSCH repetition Type A with a configured grant  <irrelevant text is 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 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. Otherwise, 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*.  <irrelevant text is omitted>  6.1.2.3.2 Transport Block repetition for uplink transmissions of PUSCH repetition Type B with a configured grant  The 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-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 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*.  <irrelevant text is omitted> |

[R1-2001546, Huawei], [R1-2001698, Nokia] proposed for Rel.16 CG with PUSCH repetition type B, when RV sequence is {0,3,0,3}, if follow the Rel.15 initial transmission occasion rule, the initial transmission of a transport block may start at any of the transmission occasions of the actual repetitions that are associated with RV=0. But when the nominal repetition is split into several actual repetitions, for RV sequence {0,3,0,3}, RV0 will also occur within the last nominal repetition as shown in Figure 1. In this case, the initial transmission of a transport block may start within the last nominal repetition, which is not aligned with the rule for the RV sequence {0,0,0,0} and will decrease the detection and the decoding performance of configured grant PUSCH transmission. Therefore, following is proposed:

* Proposal: For PUSCH transmission with a configured grant and with repetition Type B, if the higher layer parameter startingFromRV0-r16 is set to ‘on’ for RV sequence {0,3,0,3}, the initial transmission of a transport block may start at any of the transmission occasions of the actual repetitions that are associated with RV=0, except the actual repetitions within the last nominal repetition when K≥8

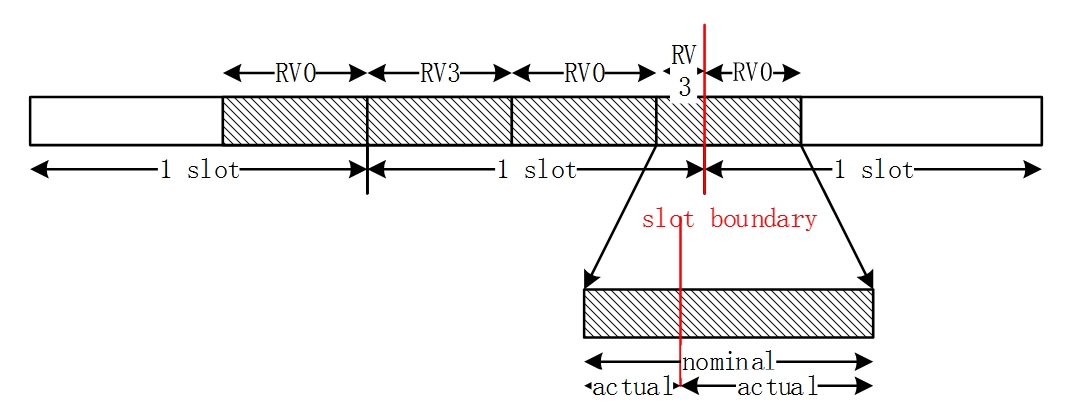


Figure 1 – Illustration of the case that the last nominal repetition split into two actual repetition

[R1-2002446, DOCOMO] and [R1-2001778, OPPO] proposed for the newly introduced repetition factor values, e.g. for repetition factor 3, 7, 12, 16, especially for repetition factors larger than 8, when the RV sequence is {0, 0, 0, 0}, the initial transmission of a transport block may start at any of the transmission occasions of the K repetitions. Since according to the Rel.16 evaluation on PUSCH miss detection probability, it is observed that PUSCH miss detection probability for single transmission is lower than the PUSCH target BLER under the respective evaluation assumptions. Therefore, Rel-15 exception is not necessary for any repetition factor for PUSCH repetition Type B.

[R1-2002087, CATT] proposed for PUSCH repetition Type A, the exception transmission occasions (TOs) for RV sequence of {0,0,0,0} when K≥8 should be clarified to be the last “valid” TO that the TO without any overlapping with DL symbols indicated by RRC for repetition Type A. Otherwise, less repetition number will be used so that the detection and the decoding performance of CG PUSCH transmission is decreased.

During the email discussion preparation phase, FL explained the background/reasons of the restriction for RV sequence of {0,0,0,0} with K=8 introduced in Rel.15 as follows:

In Rel.15, based on the evaluation result Figure 3 in R1-1709992, the UL miss detection probability difference of 1/100 corresponds to SNR difference of around 6dB. This implies that for a given target BLER setting with K repetitions, by K/4 repetitions, the UL detection can be ensured at the gNB side. So, for K=1, 2, 4, the initial transmission occasion for RV sequence of {0,0,0,0} can be any occasions since one transmission can always be ensured. However, for K=8, it was understood that UE need to transmit at least two times to let gNB detect the existence of CG PUSCH. Therefore, the restriction was added for K=8 with RV sequence of all ‘0’s.

In Rel.16, new repetition factors i.e., 3, 7, 12, 16 in addition to 1, 2, 4, 8 were introduced. In addition, based on the evaluation we did in study item on the necessity of explicit HARQ-ACK, it was observed that the miss-detection probability is not the serious issue. Therefore, Samsung and MTK seem prefer to remove the restriction for RV sequence of {0, 0, 0, 0} for any repetition factors for Rel.16 eURLLC.

Based on above, following questions are made:

* Question 1-1: on the flexible initial transmission occasion(s) for Rel.16 **PUSCH repetition Type A** with a configured grant, whether to keep the Rel.15 restriction (i.e., at least to transmit (K/4) times for gNB detection of existence of CG) for RV sequence of {0, 0, 0, 0} with K>=8 (i.e., K=8, 12, 16)?
  + If your answer is yes, are there any additional corrections needed?
  + If your answer is no, what is the proposed corrections to remove the restriction?

|  |  |
| --- | --- |
| Company | View |
| Nokia, NSB | We think the specs here are fine as they are (i.e. not related to K/4 here, but keep the K>=8 as it currently is in the specs). |
| Samsung | Agree with Nokia’s view. Keep the current specification restriction by extending condition, e.g., K>=8. |
| Panasonic | We agree with Nokia and Samsung views. To keep current specification is sufficient. In Rel.16 evaluation, it was observed that enabling additional DMRS can improve the miss-detection performance. Therefore, as far as the number of DMRS is selected properly, miss-detection would be resolved. The network has the flexibility on DMRS density, the number of repetition and the starting symbol configuration/setting. |
| LG | We are fine to remove the restriction.  Recalling the discussion on eCG and PUSCH for URLLC, miss-detection of PUSCH comes from overlapped other PUSCH occasion rather than lack of PUSCH occasion. As feature lead summarized, this restriction is not necessary for PUSCH miss-detection.  At the aspect of reliability, this restriction makes sure at least two PUSCH transmission occasions. However, those transmission occasions can be omitted/deprioritized by signaling from gNB, such as tdd-UL-DL-config, dynamic UL/DL scheduling or Slot format indication in which case anyhow such restriction may not be helpful. Moreover, Release 16 has another tool. By configuring startingFromRV0-r16, gNB can control UE behavior on flexible starting per CG configuration. |
| CATT | We need keep R15 restriction for Rel.16 PUSCH repetition Type A. And R15 restriction is to discard last TO when K=8 (not related to K/4). In addition, we need clarify last TO should be valid because if last TO is invalid for K>8, last 2nd TO is used for one time transmission which is inconsistent with R.15 restriction. |
| QC | Support not to propose restriction. |
| MediaTek | We propose to completely remove the restriction of “K>=8”. |
| Nokia / NSB  (2nd iteration) | **Further input to companies suggesting to fully remove this for Rep Type A**:  We at least need to keep the Rel-15 behavior, as if the UE is configured with a single CG using Rel-15 framework – the restriction for K=8 at least needs to be kept. So at least the K=8 needs to remain here. |
| Huawei, HiSilicon | We agree with Nokia’s view, i.e., keep the K>=8 as it currently is in the spec for RV sequence {0000}. |
| ZTE | We are fine to keep as it is or remove the restriction as MTK mentioned. |
| Intel | Fine to keep current specs. Rel.16 also supports a more suitable mechanism of multiple CG configurations for low latency with controlled reliability (fixed number of repetitions), which can be used for the latency reduction.  Complete removal of K>=8 would make it non-backward compatible. |
| vivo | We share LG views, but also admit this issue is not essential at the CR phase. So our 1st preference is to remove the restriction. 2ed preference is to keep the current spec unchanged. |
| Apple | Keeping “K>=8” as in the specification is fine. |
| OPPO | Share LG views. No restriction for K>=8 |
| Ericsson | We prefer to keep current specification as is. |
| ITRI | Prefer to keep current specification. |

Observations:

* Opt.1: Keep current specification.
  + (12) Nokia, NSB, Samsung, Panasonic, Huawei, HiSilicon, ZTE, Intel, vivo (2ed preference),Apple, Ericsson, ITRI
* Opt.2: Remove restrictions.
  + (5) LG, QC, MTK, ZTE, vivo (1st preference),OPPO
* Opt.3: Keep current specification with additional condition of the last TO for K>=8 should be the valid one (e.g. not collide with DL symbols)
  + (1) CATT
* Question 1-2: on the flexible initial transmission occasion(s) for Rel.16 **PUSCH repetition Type B** with a configured grant, whether to keep the Rel.15 restriction (i.e., at least to transmit (K/4) times for gNB detection of existence of CG) for RV sequence of {0, 0, 0, 0} with K>=8 (i.e., K=8, 12, 16)?
  + If your answer is yes, are there any additional corrections needed?
  + If your answer is no, what is the proposed corrections to remove the restriction?

|  |  |
| --- | --- |
| Company | View |
| Nokia, NSB | We think the specs here are fine as they are (i.e. not related to K/4 here, but keep the K>=8 as it currently is in the specs). |
| Samsung | Agree with Nokia’s view. Keep the current specification restriction by extending condition, e.g., K>=8. |
| Panasonic | We agree with Nokia and Samsung views. To keep current specification is sufficient from the same reason in Question 1-1. |
| LG | We are fine to remove the restriction. The reason is same as our comment on Question 1-1. |
| CATT | Yes, For Rel.16 PUSCH repetition Type B, current spec is clear to follow the Rel.15 restriction because if last nominal repetition includes actual repetitions, the last nominal repetition is valid. We needn’t change current spec for R15 restriction. |
| QC | Support not to propose restriction. |
| MediaTek | We propose to completely remove the restriction of “K>=8”. |
| Huawei, HiSilicon | We agree with Nokia’s view, i.e., keep the K>=8 as it currently is in the spec for RV sequence {0000}. |
| ZTE | We are fine to keep as it is or remove the restriction as MTK mentioned. |
| Intel | Keep current version. |
| vivo | Same answer as for Question 1-1. |
| Apple | Keeping the same design in Rel-15 is fine |
| OPPO | The same opinion as LG |
| Ericsson | We prefer to keep current specification as is. |
| ITRI | Prefer to keep current specification. |

Observations:

* Opt.1: Keep current specification.
  + (12) Nokia, NSB, Samsung, Panasonic, CATT, Huawei, HiSilicon, ZTE, Intel, vivo (2ed preference), Ericsson, ITRI
* Opt.2: Remove restrictions.
  + (5) LG, QC, MTK, ZTE, vivo (1st preference), OPPO
* Question 1-3: on the flexible initial transmission occasion(s) for Rel.16 **PUSCH repetition Type B** with a configured grant, for RV sequence of **{0, 3, 0, 3}**, current spec has no restriction for any K values. Whether to have similar restriction for {0,3,0,3} as for {0,0,0,0} that the initial transmission of a transport block may start at any of the transmission occasions of the actual repetitions that are associated with RV=0, except the actual repetitions within the last nominal repetition when K≥8??
  + If your answer is yes, are there any additional corrections needed?
  + If your answer is no, what is the proposed corrections to remove the restriction?

|  |  |
| --- | --- |
| Company | View |
| Nokia, NSB | I guess the questions would need to be changed here – as for {0,3,0,3} there is not case like this (i.e. cannot keep the Rel-15 restriction as there is none).  But anyhow, we could be fine to have a similar restriction of K>=8 also for {0,3,0,3} as for {0,0,0.0}. If one wants to keep the Rel-15 behavior alive here, we could have the restriction to start at K>8 (so that only the new larger repetition values are restricted). |
| Samsung | Keep specification without any change because all transmission occasions for configured grant can be controlled by gNB implementation. There is no critical issue to have additional restriction. |
| Panasonic | We think to keep current specification is sufficient from the same reason in Question 1-1. |
| LG | We are fine to remove the restriction. The reason is same as our comment on Question 1-1. |
| CATT | Yes, if the Rel.15 restriction is used for RV sequence of {0, 0, 0, 0}, RV sequence of {0, 3, 0, 3} need follow the Rel.15 restriction. |
| QC | Support not to propose restriction. |
| MediaTek | Similar view as Nokia, there is no such restriction in Rel-15 for RV sequence of {0, 3, 0, 3}. The only restriction is to start from TO with RV=0, which should be kept in Rel-16. |
| Huawei, HiSilicon | If we carefully look at the spec, R15 flexible start in fact has two restrictions for *K*=8. The first one is to start from RV0, and the second one is to have at least two TOs for repetitions when started. These two restrictions apply to both RV sequence {0000} and {0303}. However, for RV sequence {0303}, the second restriction can always be met if the first restriction is met. That is the reason why we don’t need the statement “except the last transmission occasion when *K*=8” also for {0303} in R15.  However, for PUSCH repetition Type B with RV sequence {0303} in R16, the last actual repetition may also be associated with RV0 due to segmentation, as shown in the following figure:  C:\Users\x00166646\AppData\Roaming\eSpace_Desktop\UserData\x00446853\imagefiles\0FE77326-4B63-4F8A-BFDA-D8C33B1169EB.png  In this sense, if to keep R15 restrictions, which we think is necessary since DMRS detection is one thing and TB decoding is another thing, the same exception is also needed for {0303} as for {0000}, i.e., “except the actual repetitions within the last nominal repetition when *K*≥8”. |
| ZTE | Keep current spec as it is. There is no big issue with the same restriction as Rel-15. |
| Intel | Keep current spec |
| vivo | Keep current spec. |
| Apple | Keep the current specification |
| OPPO | Keep the current specification |
| Ericsson | We prefer to keep current specification as is. |
| ITRI | Prefer to keep current specification. |

Observations:

* Opt.1: Keep current specification.
  + (12) Samsung, Panasonic, LG, QC, MTK, ZTE, Intel, vivo, Apple, OPPO, Ericsson, ITRI
* Opt.2: Add restriction for RV sequence {0,3,0,3} that the initial transmission of a transport block may start at any of the transmission occasions of the actual repetitions that are associated with RV=0, except the actual repetitions within the last nominal repetition when K≥8
  + (5) Nokia, NSB, CATT?, Huawei, HiSilicon

Proposals will be made based on the replies from companies.

# **Reference**

|  |  |  |
| --- | --- | --- |
| [**R1-2001546**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001546.zip) | Corrections on configured grant transmission | Huawei, HiSilicon |
| [**R1-2001616**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001616.zip) | Remaining issues on enhancements for UL configured grant transmission | ZTE |
| [**R1-2001674**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001674.zip) | Enhanced UL configured grant transmissions for URLLC | vivo |
| [**R1-2001698**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001698.zip) | Maintenance of Rel-16 URLLC Configured Grant enhancements | Nokia, Nokia Shanghai Bell |
| [**R1-2001778**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001778.zip) | Configured grant enhancements for URLLC | OPPO |
| [**R1-2001789**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001789.zip) | Remaining Issue of Enhancements to UL Configured Grant Transmission for NR URLLC | Ericsson |
| [**R1-2001924**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001924.zip) | Remaining issues of Enhanced UL configured grant transmission for NR URLLC | LG Electronics |
| [**R1-2002087**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002087.zip) | Remaining issues on enhanced UL configured grant transmission | CATT |
| [**R1-2002334**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002334.zip) | Remaining Issues in Enhanced Configured Grant Transmission | Apple |
| [**R1-2002412**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002412.zip) | Maintenance of UL grant Type 2 scheduling activation | ITRI |
| [**R1-2002446**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002446.zip) | Remaining issues for enhanced Configured grant for Rel.16 URLLC | NTT DOCOMO, INC. |

# **Appendix**

# **Agreements made in RAN1 100-e for eCG for URLLC**

[**R1-2001422**](file:///E:\laptop\RAN_1_meeting\100\RAN1\Docs\R1-2001422.zip) **Outcome of email discussion on [100e-NR-L1enh\_URLLC-eCG-01] NTT DOCOMO**

Agreements:

* Following parameters provided by *pusch-Config* are not supported as exceptions for a Type 2 configured grant activated by DCI format 0\_2
  + *resourceAllocation-ForDCIFormat0\_2,dynamic-ForDCIFormat0\_2 of UCI-OnPUSCH, dmrs-UplinkForPUSCH-MappingTypeA-ForDCIFormat0\_2 ,dmrs-UplinkForPUSCH-MappingTypeB-ForDCIFormat0\_2*
  + Note: Those parameter are replace with *resourceAllocation,* *dynamic of CG-UCI-OnPUSCH*, *cg-DMRS-Configuration* in corresponding *configuredGrantConfig* for a Type 2 configured grant activated by DCI format 0\_2, respectively.
* Following parameters provided by *pusch-Config* are not supported as exceptions for a Type 2 configured grant activated by DCI format 0\_2
  + *numberOfBitsForRV-ForDCI-Format0-2-r16, harq-ProcessNumberSizeForDCI-Format0-2-r16, dmrs-SequenceInitializationForDCI-Format0-2-r16*
  + Note: Those parameter are applied to both DCI format with C-RNTI and CS-RNTI for determining associated DCI field size.
* Following parameter provided by *pusch-Config* is supported as exceptions for a Type 2 configured grant activated by DCI format 0\_2
  + *resourceAllocationType1-granularity-ForDCIFormat0\_2*

[**R1-2001423**](file:///E:\laptop\RAN_1_meeting\100\RAN1\Docs\R1-2001423.zip) **Outcome of email discussion on [100e-NR-L1enh\_URLLC-eCG-02] NTT DOCOMO**

Agreements:

* For FDRA field for single UL grant Type 2 scheduling release PDCCH validation with DCI format 0\_1/DCI format 0\_2, keep current spec unchanged, i.e., set the value to all ‘1’s.
* For FDRA field for multiple UL grant Type 2 scheduling release PDCCH validation, keep current spec unchanged, i.e., set the value to all ‘1’s.
* Following are not supported for Rel.16 URLLC Type 2CG and SPS:
  + Use the TPC command for scheduled PUSCH field in DCI format 0\_0/0\_1/0\_2 as additional validation of activation or release for NR Rel-16 Type 2 CG.
  + Use the TPC command for scheduled PUCCH field in DCI format 1\_0/1\_1/1\_2 as additional validation of activation or release for NR Rel-16 DL SPS.

Note: no RRC impact, no TP is needed.

# **Agreements made in RAN1 100-e for eCG for NR-U**

[**R1-2001413**](file:///E:\laptop\RAN_1_meeting\100\RAN1\Docs\R1-2001413.zip) **Outcome of discussion on [100e-NR-unlic-NRU-CG-03] – TP for 38.213 vivo**

Agreement:

The following text proposals on PDCCH validation for TS 38.213 are approved.

--------------------------------- Start of Text Proposal for 38.213------------------------------------------

10.2 PDCCH validation for DL SPS and UL grant Type 2

<Unchanged parts are omitted>

Table 10.2-2: Special fields for single DL SPS or single UL grant Type 2 scheduling release PDCCH validation

|  |  |  |
| --- | --- | --- |
|  | **DCI format 0\_0/0\_1/0\_2** | **DCI format 1\_0/1\_1/1\_2** |
| HARQ process number | set to all '0's~~/0\_1/0\_2~~ | set to all '0's |
| Redundancy version | set to all '0's | set to all '0's |
| Modulation and coding scheme | set to all '1's | set to all '1's |
| Frequency domain resource assignment | set to all ‘0’s for FDRA Type 0 or Type 2 with ,  set to all '1's for FDRA Type 1 or FDRA Type 2 with , | set to all '0's for FDRA Type 0 set to all '1's for FDRA Type 1 |

<Unchanged parts are omitted>

Table 10.2-4: Special fields for multiple DL SPS and UL grant Type 2 scheduling release PDCCH validation

|  |  |  |
| --- | --- | --- |
|  | **DCI format 0\_0/0\_1/0\_2** | **DCI format 1\_0/1\_1/1\_2** |
| Redundancy version | set to all '0's | set to all '0's |
| Modulation and coding scheme | set to all '1's | set to all '1's |
| Frequency domain resource assignment | set to all ‘0’s for FDRA Type 0 or Type 2 with ,  set to all '1's for FDRA Type 1 or FDRA Type 2 with , | set to all '0's for FDRA Type 0  set to all '1's for FDRA Type 1 |

<Unchanged parts are omitted>

--------------------------------- End of Text Proposal for 38.213------------------------------------------

--------------------------------- Start of Text Proposal for 38.213------------------------------------------

10.2 PDCCH validation for DL SPS and UL grant Type 2

A UE validates, for scheduling activation or scheduling release, a DL SPS assignment PDCCH or configured UL grant Type 2 PDCCH if

- the CRC of a corresponding DCI format is scrambled with a CS-RNTI provided by cs-RNTI, and

- the new data indicator field in the DCI format for the enabled transport block is set to '0', and

- the DFI flag field, if present, in the DCI format indicating CG-DFI is set to ‘0’.

< Unchanged parts are omitted >

--------------------------------- End of Text Proposal for 38.213------------------------------------------