**3GPP TSG-RAN WG1 Meeting #114 *R1-230xxxx***

**Toulouse, France, August 21st – 25th, 2023**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.214** | **CR** | **-** | **rev** | **-** | **Current version:** | **17.6.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** |  | | | | | | |
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| ***Source to WG:*** | Nokia | | | | | | |
| ***Source to TSG:*** |  | | | | | | |
|  |  | | | | | | |
| ***Work item code:*** | NR\_XR\_enh-Core | | |  | ***Date:*** | | 2023-08-09 |
|  |  | |  | |  | |  |
| ***Category:*** | **B** |  | | | ***Release:*** | | Rel-18 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
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| ***Reason for change:*** | | Introduction of specification for XR Enhancements for NR | | | | | |
|  | |  | | | | | |
| ***Summary of change:*** | | This document is introducing specification support for configured grant | | | | | |
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| ***Consequences if not approved:*** | **Specification does not support XR enhancements** | | | |
|  |  | | | |
| ***Clauses affected:*** | 5.2.3, 6.1, 6.1.2.3 | | | |
|  |  | | | |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  | Other core specifications | TS/TR ... CR ... |
| ***affected:*** |  | **X** | Test specifications | TS/TR ... CR ... |
| ***(show related CRs)*** |  | **X** | O&M Specifications | TS/TR ... CR ... |
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| ***Other comments:*** |  | | | |
|  |  | | | |
| ***This CR's revision history:*** |  | | | |

<omitted text>

### 5.2.3 CSI reporting using PUSCH

A UE shall perform aperiodic CSI reporting using PUSCH on serving cell c upon successful decoding of a DCI format 0\_1 or DCI format 0\_2 which triggers an aperiodic CSI trigger state.

When a DCI format 0\_1 schedules two PUSCH allocations, the aperiodic CSI report is carried on the second scheduled PUSCH. When a DCI format 0\_1 schedules more than two PUSCH allocations, the aperiodic CSI report is carried on the penultimate scheduled PUSCH.

An aperiodic CSI report carried on the PUSCH supports wideband, and sub-band frequency granularities. An aperiodic CSI report carried on the PUSCH supports Type I, Type II, Enhanced Type II and Further Enhanced Type II Port Selection CSI.

A UE shall perform semi-persistent CSI reporting on the PUSCH upon successful decoding of a DCI format 0\_1 or DCI format 0\_2 which activates a semi-persistent CSI trigger state. DCI format 0\_1 and DCI format 0\_2 contains a CSI request field which indicates the semi-persistent CSI trigger state to activate or deactivate. Semi-persistent CSI reporting on the PUSCH supports Type I, Type II with wideband, and sub-band frequency granularities, Enhanced Type II and Further Enhanced Type II Port Selection CSI. The PUSCH resources and MCS shall be allocated semi-persistently by an uplink DCI.

CSI reporting on PUSCH can be multiplexed with uplink data on PUSCH except that semi-persistent CSI reporting on PUSCH activated by a DCI format is not expected to be multiplexed with uplink data on the PUSCH. CSI reporting on PUSCH can also be performed without any multiplexing with uplink data from the UE.

Type I CSI feedback is supported for CSI Reporting on PUSCH. Type I wideband and sub-band CSI is supported for CSI Reporting on the PUSCH. Type II CSI is supported for CSI Reporting on the PUSCH.

For Type I, Type II, Enhanced Type II and Further Enhanced Type II Port Selection CSI feedback on PUSCH, a CSI report comprises of two parts. Part 1 has a fixed payload size and is used to identify the number of information bits in Part 2. Part 1 shall be transmitted in its entirety before Part 2.

- For Type I CSI feedback, Part 1 contains RI (if reported), CRI (if reported), CQI for the first codeword (if reported). Part 2 contains PMI (if reported), LI (if reported) and contains the CQI for the second codeword (if reported) when RI is larger than 4. For a *CSI-ReportConfig* configured with *codebookType* set to 'typeI-SinglePanel' and the corresponding CSI-RS Resource Set for channel measurement configured with two Resource Groups and Resource Pairs, Part 1 contains RI(s), CRI(s), CQI(s) for the first codeword and is zero padded to a fixed payload size (if needed). Part 2 contains the CQI(s) for the second codeword (if reported) when RI is larger than 4, LIs (if reported) and PMI(s).

- For Type II CSI feedback, Part 1 contains RI (if reported), CQI, and an indication of the number of non-zero wideband amplitude coefficients per layer for the Type II CSI (see Clause 5.2.2.2.3). The fields of Part 1 – RI (if reported), CQI, and the indication of the number of non-zero wideband amplitude coefficients for each layer – are separately encoded. Part 2 contains the PMI and LI (if reported) of the Type II CSI. The elements of , (if reported) and (if reported) are reported in the increasing order of their indices, , where the element of the lowest index is mapped to the most significant bits and the element of the highest index is mapped to the least significant bits. Part 1 and 2 are separately encoded.

- For Enhanced Type II CSI feedback (see Clause 5.2.2.2.5) and Further Enhanced Type II Port Selection CSI feedback (see Clause 5.2.2.2.7), Part 1 contains RI (if reported), CQI, and an indication of the overall number of non-zero amplitude coefficients across layers. The fields of Part 1 – RI (if reported), CQI, and the indication of the overall number of non-zero amplitude coefficients across layers – are separately encoded. Part 2 contains the PMI of the Enhanced Type II or Further Enhanced Type II Port Selection CSI. Part 1 and 2 are separately encoded.

A Type II CSI report that is carried on the PUSCH shall be computed independently from any Type II CSI report that is carried on the PUCCH formats 3 or 4 (see Clause 5.2.4 and 5.2.2).

When the higher layer parameter *reportQuantity* is configured with one of the values 'cri-RSRP', 'ssb-Index-RSRP', 'cri-SINR' or 'ssb-Index-SINR', or 'cri-RSRP- Index', 'ssb-Index-RSRP- Index ', 'cri-SINR- Index ', 'ssb-Index-SINR- Index ',the CSI feedback consists of a single part.

For both Type I and Type II reports configured for PUCCH but transmitted on PUSCH, the determination of the payload for CSI part 1 and CSI part 2 follows that of PUCCH as described in Clause 5.2.4.

When CSI reporting on PUSCH comprises two parts, the UE may omit a portion of the Part 2 CSI. Omission of Part 2 CSI is according to the priority order shown in Table 5.2.3-1, where  is the number of CSI reports configured to be carried on the PUSCH. Priority 0 is the highest priority and priority  is the lowest priority and the CSI report *n* corresponds to the CSI report with the *n*th smallest Prii,CSI(*y,k,c,s*) value among the  CSI reports as defined in Clause 5.2.5. The subbands for a given CSI report *n* indicated by the higher layer parameter *csi-ReportingBand* with value '1' are numbered continuously in increasing order with the lowest subband of *csi-ReportingBand* with value set to '1' as subband 0. When omitting Part 2 CSI information for a particular priority level, the UE shall omit all of the information at that priority level.

- For Enhanced Type II reports, for a given CSI report , each reported element of indices and , indexed by and , is associated with a priority value , with with , , and , and where is defined in Clause 5.2.2.2.5. The element with the highest priority has the lowest associated value . Omission of Part 2 CSI is according to the priority order shown in Table 5.2.3-1, where

- Group 0 includes indices (if reported), (if reported) and ().

- Group 1 includes indices (if reported), (if reported), the highest priority elements of , , the highest priority elements of and the highest priority elements of ().

- Group 2 includes the lowest priority elements of , the lowest priority elements of and the lowest priority elements of ().

- For Further Enhanced Type II Port Selection reports, for a given CSI report , each reported element of and , indexed by , and , is associated with a priority value , with , and . The element with the highest priority has the lowest associated value . Omission of Part 2 CSI is according to the priority order shown in Table 5.2.3-1, where:

- Group 0 includes (if reported), () and (if reported).

- Group 1 includes the highest priority elements of (if reported), , the highest priority elements of and the highest priority elements of ().

- Group 2 includes the lowest priority elements of (if reported), the lowest priority elements of and the lowest priority elements of ().

Table 5.2.3-1: Priority reporting levels for Part 2 CSI

|  |
| --- |
| Priority 0:  For CSI reports 1 to , Group 0 CSI for CSI reports configured as 'typeII-r16', 'typeII-PortSelection-r16' or 'typeII-PortSelection-r17'; Part 2 wideband CSI for CSI reports configured otherwise |
| Priority 1:  Group 1 CSI for CSI report 1, if configured as 'typeII-r16', 'typeII-PortSelection-r16' or 'typeII-PortSelection-r17'; Part 2 subband CSI of even subbands for CSI report 1, if configured otherwise |
| Priority 2:  Group 2 CSI for CSI report 1, if configured as 'typeII-r16', 'typeII-PortSelection-r16' or 'typeII-PortSelection-r17'; Part 2 subband CSI of odd subbands for CSI report 1, if configured otherwise |
| Priority 3:  Group 1 CSI for CSI report 2, if configured as 'typeII-r16', 'typeII-PortSelection-r16' or 'typeII-PortSelection-r17'; Part 2 subband CSI of even subbands for CSI report 2, if configured otherwise |
| Priority 4:  Group 2 CSI for CSI report 2, if configured as 'typeII-r16', 'typeII-PortSelection-r16' or 'typeII-PortSelection-r17'. Part 2 subband CSI of odd subbands for CSI report 2, if configured otherwise |
| ⁞ |
| Priority :  Group 1 CSI for CSI report , if configured as 'typeII-r16', 'typeII-PortSelection-r16' or 'typeII-PortSelection-r17'; Part 2 subband CSI of even subbands for CSI report , if configured otherwise |
| Priority :  Group 2 CSI for CSI report , if configured as 'typeII-r16', 'typeII-PortSelection-r16' or 'typeII-PortSelection-r17'; Part 2 subband CSI of odd subbands for CSI report , if configured otherwise |

When the UE is scheduled to transmit a transport block on PUSCH not using repetition type B multiplexed with a CSI report(s), Part 2 CSI is omitted only when  is larger than , where parameters , , , , , , , , , and are defined in Clause 6.3.2.4 of [5, TS 38.212].

Part 2 CSI is omitted level by level, beginning with the lowest priority level until the lowest priority level is reached which causes the  to be less than or equal to .

When the UE is scheduled to transmit a transport block on PUSCH using repetition type B multiplexed with a CSI report(s), Part 2 CSI is omitted only when

is larger than

,

where parameters , , , , , , , , , , , and are defined in Clause 6.3.2.4 of [5, TS 38.212].

Part 2 CSI is omitted level by level, beginning with the lowest priority level until the lowest priority level is reached which causes

to be less than or equal to

.

When part 2 CSI is transmitted on PUSCH with no transport block, lower priority bits are omitted until Part 2 CSI code rate, which is given by where , , are given in clause 6.3.2.4 of [5, 38.212] before HARQ-ACK puncturing part 2 CSI if any, is below a threshold code rate lower than one, where



- is the CSI offset value from Table 9.3-2 of [6, TS 38.213]

- *R* is signaled code rate in DCI

If the UE is in an active semi-persistent CSI reporting configuration on PUSCH, the CSI reporting is deactivated when either the downlink BWP or the uplink BWP is changed. Another activation command is required to enable the semi-persistent CSI reporting.

<omitted text>

## 6.1 UE procedure for transmitting the physical uplink shared channel

PUSCH transmission(s) can be dynamically scheduled by an UL grant in a DCI, or the transmission can correspond to a configured grant Type 1 or Type 2. The configured grant Type 1 PUSCH transmission is semi-statically configured to operate upon the reception of higher layer parameter of *configuredGrantConfig* including *rrc-ConfiguredUplinkGrant* without the detection of an UL grant in a DCI. The configured grant Type 2 PUSCH transmission is semi-persistently scheduled by an UL grant in a valid activation DCI according to clause 10.2 of [6, TS 38.213] after the reception of higher layer parameter *configuredGrantConfig* not including *rrc-ConfiguredUplinkGrant*. If *configuredGrantConfigToAddModList* is configured, more than one configured grant configuration of configured grant Type 1 and/or configured grant Type 2 may be active at the same time on an active BWP of a serving cell.

The UE can be configured with a list of up to 64 *TCI-UL-State* configurations within the higher layer parameter *BWP-UplinkDedicated.* Each *TCI-UL-State* configuration contains a parameter for configuring one reference signal, if applicable, for determining UL TX spatial filter for dynamic-grant and configured-grant based PUSCH and PUCCH resource in a CC, and SRS.

For the PUSCH transmission corresponding to a Type 1 configured grant or a Type 2 configured grant activated by DCI format 0\_0 or 0\_1, the parameters applied for the transmission are provided by *configuredGrantConfig* except for *dataScramblingIdentityPUSCH*, *txConfig*, *codebookSubset*, *maxRank*, *scaling* of *UCI-OnPUSCH,* which are provided by *pusch-Config*. For the PUSCH transmission corresponding to a Type 2 configured grant activated by DCI format 0\_2, the parameters applied for the transmission are provided by *configuredGrantConfig* except for *dataScramblingIdentityPUSCH*, *txConfig*, *codebookSubsetDCI-0-2*, *maxRankDCI-0-2*, *scaling* of *UCI-OnPUSCH*, *resourceAllocationType1GranularityDCI-0-2* provided by *pusch-Config*.If the UE is provided with *transformPrecoder* in *configuredGrantConfig*, the UE applies the higher layer parameter *tp-pi2BPSK*, if provided in *pusch-Config*, according to the procedure described in clause 6.1.4 for the PUSCH transmission corresponding to a configured grant. 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. If *[nrofSlots\_InCGperiod]* is configured for Type 1 configured grant or Type 2 configured grant, HARQ process ID is determined as in clause [5.4.1] of [10, TS 38.321] for PUSCH transmission(s) not overlapping with a DL symbol indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, or a symbol of an SS/PBCH block with index provided by *ssb-PositionsInBurst*.

For the PUSCH retransmission scheduled by a PDCCH with CRC scrambled by CS-RNTI with NDI=1, the parameters in *pusch-Config* are applied for the PUSCH transmission except for *p0-NominalWithoutGrant, p0-PUSCH-Alpha, powerControlLoopToUse,* *pathlossReferenceIndex* described in clause 7.1 of [6, TS 38.213], *mcs-Table, mcs-TableTransformPrecoder* described in clause 6.1.4.1 and *transformPrecoder* described in clause 6.1.3.

For a UE configured with two uplinks in a serving cell, PUSCH retransmission for a TB on the serving cell is not expected to be on a different uplink than the uplink used for the PUSCH initial transmission of that TB.

A UE shall upon detection of a PDCCH with a configured DCI format 0\_0, 0\_1 or 0\_2 transmit the corresponding PUSCH as indicated by that DCI unless the UE does not generate a transport block as described in [10, TS38.321]. Upon detection of a DCI format 0\_1 or 0\_2 with '*UL-SCH indicator*' set to '0' and with a non-zero '*CSI request*' where the associated *reportQuantity* in *CSI-ReportConfig* set to '*none*' for all CSI report(s) triggered by '*CSI request*' in this DCI format 0\_1 or 0\_2, the UE ignores all fields in this DCI except the '*CSI request*' and the UE shall not transmit the corresponding PUSCH as indicated by this DCI format 0\_1 or 0\_2. When the UE is scheduled with multiple PUSCHs by a DCI, HARQ process ID indicated by this DCI applies to the first PUSCH not overlapping with a DL symbol indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, or a symbol of an SS/PBCH block with index provided by *ssb-PositionsInBurst*, HARQ process ID is then incremented by 1 for each subsequent PUSCH(s) in the scheduled order, with modulo operation of *nrofHARQ-ProcessesForPUSCH* applied if *nrofHARQ-ProcessesForPUSCH* is provided, or with modulo operation of *nrofHARQ-ProcessesForPUSCH-r17* applied if *nrofHARQ-ProcessesForPUSCH-r17* is provided, or with modulo operation of 16 applied, otherwise. HARQ process ID is not incremented for PUSCH(s) not transmitted if at least one of the symbols indicated by the indexed row of the used resource allocation table in the slot overlaps with a DL symbol indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, or a symbol of an SS/PBCH block with index provided by *ssb-PositionsInBurst*. For any HARQ process ID(s) in a given scheduled cell, the UE is not expected to transmit a PUSCH that overlaps in time with another PUSCH. Except for the case when a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* for the active BWP of a serving cell and PDCCHs that schedule two non-overlapping in time domain PUSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex,* for any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start a first PUSCH transmission starting in symbol *j* by a PDCCH ending in symbol *i* on a scheduling cell,, the UE is not expected to be scheduled to transmit a PUSCH starting earlier than the end of the first PUSCH by a PDCCH that ends later than symbol *i* of the scheduling cell. When the PDCCH reception includes two PDCCH candidates from two respective search space sets, as described in clause 10.1 of [6, TS 38.213], for the purpose of determining the PDCCH ending in symbol *i*, the PDCCH candidate that ends later in time is used. The UE is not expected to be scheduled to transmit another PUSCH by a DCI format 0\_0 with CRC scrambled by TC-RNTI, for a given HARQ process with the DCI received before the end of the expected transmission of the last PUSCH for that HARQ process if the latter is scheduled by a DCI format 0\_0 with CRC scrambled by TC-RNTI or by an UL grant in RA Response. The UE is not expected to be scheduled to transmit another PUSCH by DCI format 0\_0, 0\_1 or 0\_2 scrambled by C-RNTI, CS-RNTI or MCS-C-RNTI for a given HARQ process with the DCI received before the end of the expected transmission of the last PUSCH for that HARQ process if the latter is scheduled by a DCI with CRC scrambled by C-RNTI, CS-RNTI or MCS-C-RNTI.

If a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* for the active BWP of a serving cell and PDCCHs that schedule two non-overlapping in time domain PUSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex,* for any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start a first PUSCH transmission starting in symbol *j* by a PDCCH associated with a value of *coresetPoolIndex* ending in symbol *i*, the UE can be scheduled to transmit a PUSCH starting earlier than the end of the first PUSCH by a PDCCH associated with a different value of *coresetPoolIndex* that ends later than symbol *i*.

A UE is not expected to be scheduled by a PDCCH ending in symbol to transmit a PUSCH on a given serving cell overlapping in time with a transmission occasion, where the UE is allowed to transmit a PUSCH with configured grant according to [10, TS38.321], starting in a symbol on the same serving cell if the end of symbol is not at least symbols before the beginning of symbol , if the UE is not provided *prioLowDG-HighCG* or *prioHighDG-LowCG*, or the UE is provided *prioLowDG-HighCG* or *prioHighDG-LowCG* and the two PUSCHs have the same priority index as described in Clause 9 of [6, TS 38.213]. The value in symbols is determined according to the UE processing capability defined in Clause 6.4, and and the symbol duration are based on the minimum of the subcarrier spacing corresponding to the PUSCH with configured grant and the subcarrier spacing of the PDCCH scheduling the PUSCH.

If a UE receives an ACK for a given HARQ process in CG-DFI in a PDCCH ending in symbol *i* to terminate a transport block repetition in a PUSCH transmission with a configured grant on a given serving cell with the same HARQ process after symbol *i*, the UE is expected to terminate the repetition of the transport block in a PUSCH transmission starting from a symbol *j* if the gap between the end of PDCCH of symbol *i* and the start of the PUSCH transmission in symbol *j* is equal to or more than *N2* symbols. The value *N2* in symbols is determined according to the UE processing capability defined in Clause 6.4, and *N2* and the symbol duration are based on the minimum of the subcarrier spacing corresponding to the PUSCH and the subcarrier spacing of the PDCCH indicating CG-DFI. A UE is not expected to be scheduled by a PDCCH ending in symbol to transmit a PUSCH on a given serving cell for a given HARQ process, if there is a transmission occasion where the UE is allowed to transmit a PUSCH with configured grant according to [10, TS38.321] with the same HARQ process on the same serving cell starting in a symbol after symbol , and if the gap between the end of PDCCH and the beginning of symbol is less than symbols. The value in symbols is determined according to the UE processing capability defined in clause 6.4, and and the symbol duration are based on the minimum of the subcarrier spacing corresponding to the PUSCH with configured grant and the subcarrier spacing of the PDCCH scheduling the PUSCH.

For PUSCH scheduled by DCI format 0\_0 on a cell, the UE shall transmit PUSCH according to the spatial relation, if applicable, corresponding to the dedicated PUCCH resource with the lowest ID within the active UL BWP of the cell, as described in Clause 9.2.1 of [6, TS 38.213]. If the dedicated PUCCH resource with the lowest ID within the active UL BWP of the cell corresponds to two spatial relations, the UE shall transmit the PUSCH according to the spatial relation with the lower ID.

For PUSCH scheduled by DCI format 0\_0 on a cell and if the higher layer parameter *enableDefaultBeamPL-ForPUSCH0-0* is set 'enabled', the UE is not configured with PUCCH resources on the active UL BWP and the UE is in RRC connected mode, the UE shall transmit PUSCH according to the spatial relation, if applicable, with a reference to the RS configured with *qcl-Type* set to 'typeD' corresponding to the QCL assumption of the CORESET with the lowest ID on the active DL BWP of the cell. If the CORESET is indicated with two TCI states, *sfnSchemePdcch* is configured and the UE supports *sfn-DefaultUL-BeamSetup-r17*, the UE shall use the first TCI state as the QCL assumption.

For PUSCH scheduled by DCI format 0\_0 on a cell and if the higher layer parameter *enableDefaultBeamPL-ForPUSCH0-0* is set 'enabled', the UE is configured with PUCCH resources on the active UL BWP where all the PUCCH resource(s) are not configured with any spatial relation and the UE is in RRC connected mode, the UE shall transmit PUSCH according to the spatial relation, if applicable, with a reference to the RS configured with *qcl-Type* set to 'typeD' corresponding to the QCL assumption of the CORESET with the lowest ID on the active DL BWP of the cell in case CORESET(s) are configured on the cell. If the CORESET is indicated with two TCI states, *sfnSchemePdcch* is configured and the UE supports *sfn-DefaultUL-BeamSetup-r17*, the UE shall use the first TCI state as the QCL assumption.

For uplink, 16 HARQ processes per cell are supported by the UE, or subject to UE capability, a maximum of 32 HARQ processes per cell as defined in [13, TS 38.306]. The number of processes the UE may assume will at most be used for the uplink is configured to the UE for each cell separately by higher layer parameter *nrofHARQ-ProcessesForPUSCH*, or *nrofHARQ-ProcessesForPUSCH-r17,* and when no configuration is provided the UE may assume a default number of 16 processes.

<omitted text>

#### 6.1.2.3 Resource allocation for uplink transmission with configured grant

When PUSCH resource allocation is semi-statically configured by higher layer parameter *configuredGrantConfig* in *BWP-UplinkDedicated* information element, and the PUSCH transmission corresponding to a configured grant, the following higher layer parameters are applied in the transmission:

- For Type 1 PUSCH transmissions with a configured grant, the following parameters are given in *configuredGrantConfig* unless mentioned otherwise:

- For the determination of the PUSCH repetition type, if the higher layer parameter *pusch-RepTypeIndicator* in *rrc-ConfiguredUplinkGrant* is configured and set to 'pusch-RepTypeB', PUSCH repetition type B is applied; otherwise, PUSCH repetition type A is applied;

- For PUSCH repetition type A, the selection of the time domain resource allocation table follows the rules for DCI format 0\_0 on UE specific search space, as defined in Clause 6.1.2.1.1.

- For PUSCH repetition type B, the selection of the time domain resource allocation table is as follows:

- If *pusch-RepTypeIndicatorDCI-0-1* in *pusch-Config* is configured and set to *'*pusch-RepTypeB*'*, *pusch-TimeDomainAllocationListDCI-0-1* in *pusch-Config* is used;

- Otherwise, *pusch-TimeDomainAllocationListDCI-0-2* in *pusch-Config* is used.

- It is not expected that *pusch-RepTypeIndicator* in *rrc-ConfiguredUplinkGrant* is configured with *'*pusch-RepTypeB*'* when none of *pusch-RepTypeIndicatorDCI-0-1* and *pusch-RepTypeIndicatorDCI-0-2* in *pusch-Config* is set to *'*pusch-RepTypeB*'*.

- The higher layer parameter *timeDomainAllocation* value *m* provides a row index *m*+1 pointing to the determined time domain resource allocation table, where the start symbol and length are determined following the procedure defined in Clause 6.1.2.1;

- Frequency domain resource allocation is determined by the *N* LSB bits in the higher layer parameter *frequencyDomainAllocation*, forming a bit sequence , where is the LSB, according to the procedure in Clause 6.1.2.2 and *N* is determined as the size of frequency domain resource assignment field in DCI format 0\_1 for a given resource allocation type indicated by *resourceAllocation,* except if *useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated* is configured, in which case uplink type 2 resource allocation is used wherein the UE interprets the LSB bits in the higher layer parameter *frequencyDomainAllocation* as for the frequency domain resource assignment field of DCI 0\_1 according to the procedure in Clause 6.1.2.2.3*;*

- The *IMCS* is provided by higher layer parameter *mcsAndTBS;*

- Number of DM-RS CDM groups, DM-RS ports, SRS resource indication and DM-RS sequence initialization are determined as in Clause 7.3.1.1.2 of [5, TS 38.212], and the antenna port value, the bit value for DM-RS sequence initialization, precoding information and number of layers, SRS resource indicator are provided by *antennaPort, dmrs-SeqInitialization, precodingAndNumberOfLayers*, and *srs-ResourceIndicator* respectively; When two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2,* precoding information and number of layers (applicable when higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook') associated with the first and second SRS resource set is provided by *precodingAndNumberOfLayers and precodingAndNumberOfLayers2,* respectively, and SRS resource indicators associated with the first and second SRS resource sets are provided by *srs-ResourceIndicator* and *srs-ResourceIndicator2,* respectively. When both *srs-ResourceSetToAddModList* and *srs-ResourceSetToAddModListDCI-0-2* are configured with two SRS resource sets, the two SRS resource sets configured by *srs-ResourceSetToAddModList* is used to determine the SRS resource indications by *srs-ResourceIndicator* and *srs-ResourceIndicator2.*

- If two SRS resource sets with usage set to 'codebook' or 'noncodebook' are configured in *srs-ResourceSetToAddModList*, the two SRS resource sets are used to determine the SRS resource indications by *srs-ResourceIndicator* and *srs-ResourceIndicator2*.

- otherwise, the two SRS resource sets with usage set to 'codebook' or 'noncodebook' configured in *srs-ResourceSetToAddModListDCI-0-2* are used to determine the SRS resource indications by *srs-ResourceIndicator* and *srs-ResourceIndicator2*.

- When frequency hopping is enabled, the frequency offset between two frequency hops can be configured by higher layer parameter *frequencyHoppingOffset.*

- For Type 2 PUSCH transmissions with a configured grant: the resource allocation follows the higher layer configuration according to [10, TS 38.321], and UL grant received on the DCI.

- The PUSCH repetition type and the time domain resource allocation table are determined by the PUSCH repetition type and the time domain resource allocation table associated with the UL grant received on the DCI, respectively, as defined in Clause 6.1.2.1. The value of Koffset, if configured, is applied when determining the first transmission opportunity.

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, when two SRS resource sets are configured in srs-*ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2*, the SRS resource set association to (nominal) repetitions follows *MappingPattern* in *ConfiguredGrantConfig* as defined in Clause 6.1.2.1 for PUSCH scheduled by DCI format 0\_1 and 0\_2. For PUSCH transmissions with a Type 1 configured grant, when two SRS resource sets with usage set to 'codebook' or 'noncodebook' are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2*, if *p0-PUSCH-Alpha2* is provided, the SRS resource set association to (nominal) repetitions is determined as follows. When K = 2, the first and second SRS resource sets are applied to the first and second (nominal) repetitions, respectively.

- When K > 2 and *cyclicMapping* in *ConfiguredGrantConfig* is enabled, the first and second SRS resource sets are applied to the first and second (nominal) repetitions, respectively, and the same SRS resource set mapping pattern continues to the remaining (nominal) repetitions.

- When K > 2 and *sequentialMapping* in *ConfiguredGrantConfig* is enabled, first SRS resource set is applied to the first and second (nominal) repetitions, and the second SRS resource set is applied to the third and fourth (nominal) repetitions, and the same SRS resource set mapping pattern continues to the remaining (nominal) repetitions.

For PUSCH transmissions with a Type 1 configured grant, when two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2*, if configuredGrantConfig contains only one *pathlossReferenceIndex, p0-PUSCH-Alpha, powerControlLoopToUse,* *srs-ResourceIndicator* and *precodingAndNumberOfLayers* (applicable when higher layer parameter usage in *SRS-ResourceSet* set to 'codebook'), PUSCH repetitions are associated only with the first SRS resource set.

If the UE is provided two SRS resource sets in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with *usage* set to 'codebook' or 'nonCodebook', and the UE is not provided *p0-PUSCH-Alpha2* and *powerControlLoopToUse2*, for a retransmission of a configured grant Type 1 PUSCH, or for activation or retransmission of a configured grant Type 2 PUSCH, scheduled by a DCI format that includes an SRS resource set indicator field, the UE expects the value of the SRS resource set indicator field to be set to '00', and PUSCH repetitions are associated only with the first SRS resource set.

The UE shall not transmit anything on the resources configured by *configuredGrantConfig* if the higher layers did not deliver a transport block to transmit on the resources allocated for uplink transmission without grant.

A set of allowed periodicities *P* are defined in [12, TS 38.331]. The higher layer parameters *cg-nrofSlots* and *[nrofSlots\_InCGperiod]*, provide the number of consecutive slots allocated within a configured grant period. If *cg-nrofSlots* if configured, the higher layer parameter *cg-nrofPUSCH-InSlot* provides the number of consecutive PUSCH allocations within a slot, where the first PUSCH allocation follows the higher layer parameter *timeDomainAllocation* for Type 1 PUSCH transmission or the higher layer configuration according to [10, TS 38.321], and UL grant received on the DCI for Type 2 PUSCH transmissions, and the remaining PUSCH allocations have the same length and PUSCH mapping type, and are appended following the previous allocations without any gaps. The same combination of start symbol and length and PUSCH mapping type repeats over the consecutively allocated slots. If [*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.

For operation with shared spectrum channel access, and when the higher layer parameter *semiStaticChannelAccessConfigUE* is not configured, where a UE is performing uplink transmission with configured grants in contiguous OFDM symbols on all resource blocks of an RB set, for the first such UL transmission the UE determines a duration of a cyclic prefix extension *Text* to be applied for transmission according to [4, TS 38.211] where the index for [4, TS 38.211] is chosen randomly from a set of values configured by higher layers according to the following rule:

- If the first such UL transmission is within a channel occupancy initiated by the gNB (defined in Clause 4 of [16, TS 37.213]), the set of values is determined by *cg-StartingFullBW-InsideCOT*;

- otherwise, the set of values is determined by *cg-StartingFullBW-OutsideCOT*.

For operation with shared spectrum channel access, and when the higher layer parameter *semiStaticChannelAccessConfigUE* is not configured, where a UE is performing uplink transmission with configured grants in contiguous OFDM symbols on fewer than all resource blocks of an RB set, for the first such UL transmission the UE determines a duration of a cyclic prefix extension *Text* to be applied for transmission according to [4, TS 38.211] according to the following rule:

- If the first such UL transmission is within a channel occupancy initiated by the gNB (defined in Clause 4 of [16, TS 37.213]), the index for [4, TS 38.211] is equal to *cg-StartingPartialBW-InsideCOT*;

- otherwise, the index for [4, TS 38.211] is equal to *cg-StartingPartialBW-OutsideCOT.*

<omitted text>