**3GPP TSG- RAN WG1 Meeting #107-e R1-** **211xxxx**

**e-Meeting, November 11th – 19th, 2021**

Agenda Item: 7.2.6

Source: Apple Inc.

Title: Summary of email thread [107-e-NR-eMIMO-02]

Document for: Discussion/Decision

# Introduction

In this contribution, we provide a summary on email discussion thread [10**7**-e-NR-eMIMO-02].

[10**7**-e-NR-eMIMO-02] Miscellaneous corrections on Rel-16 NR-MIMO by Nov 15

-       R1-2112399, R1-2111851, R1-2111672, R1-2111219, R1-2112355

-       For recommendations to editors only

# Companies view

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| Company | Comments |
| Apple | Support all TPs |
| Samsung | Support all TPs except the TP in section 6 from CATT (R1-2111219), since the same TP except a part of enhanced Type II for Rel-15 CR is also discussed in AI 7.1 on the email thread [107-e-NR-7.1CRs-14] (R1-2112334). Hence we support enhanced Type II part only for the TP in section 6. |
| Huawei | Support all TPs except for TP from CATT, which shall only address Rel-16 as following (which are fine as well) for clearer maintenance/spec update. We have the same understanding as Samsung.  - For Enhanced Type II CSI feedback, Part 1 contains RI(if reported), CQI, and an indication of the overall number of non-zero amplitude coefficients across layers for the Enhanced Type II CSI (see Clause 5.2.2.2.5). 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 CSI. Part 1 and 2 are separately encoded. |

# R1-2112399

## Background

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| ***Reason for change:*** | In the description of MAC CE application timeline for SP-SRS resource activation, there is a duplicated description of “in slot n”, i.e., “*when the UE would transmit a PUCCH with HARQ-ACK information in slot n corresponding to the PDSCH carrying the activation command is transmitted in slot n*”, which may result in misunderstanding both HARQ-ACK and the MAC-CE are transmitted in the same slot, actually, the intention of the sentence here is that HARQ-ACK is transmitted in slot n. So, the second “transmitted in slot n” should be removed.In the description of MAC CE application timeline for spatial relation update of AP-SRS, the reference SCS is undefined and should be clarified. |
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| ***Summary of change:*** | 1. To remove the duplicated statement of “*is transmitted in slot n*” in the decription of MAC CE application timeline for SP-SRS resource activation; 2. To add the definition of reference SCS in the decription of MAC CE application timeline for AP-SRS spatial relation udpate. |
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| ***Consequences if not approved:*** | The MAC CE application timeline for SP-SRS resource activation and AP-SRS spatial relation update are unclear. |

## Text Proposal for 38.214

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| 6.2.1 UE sounding procedure < Unchanged parts are omitted >  For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter *resourceType* in *SRS-Resource* or *SRS-PosResource* is set to 'semi-persistent':  - when a UE receives an activation command, as described in clause 6.1.3.17 or 6.1.3.36 of [10, TS 38.321], for an SRS resource, and when the UE would transmit a PUCCH with HARQ-ACK information in slot *n* corresponding to the PDSCH carrying the activation command, the corresponding actions in [10, TS 38.321] and the UE assumptions on SRS transmission corresponding to the configured SRS resource set shall be applied starting from the first slot that is after slot where ** is the SCS configuration for the PUCCH. The activation command also contains spatial relation assumptions provided by a list of references to reference signal IDs, one per element of the activated SRS resource set. When the SRS is configured with the higher layer parameter *SRS-ResourceSet*, each ID in the list refers to a reference SS/PBCH block, NZP CSI-RS resource configured on serving cell indicated by *Resource Serving Cell ID* field in the activation command if present, same serving cell as the SRS resource set otherwise, or SRS resource configured on serving cell and uplink bandwidth part indicated by Resource *Serving Cell ID* field and *Resource BWP ID* field in the activation command if present, same serving cell and bandwidth part as the SRS resource set otherwise. When the SRS is configured with the higher layer parameter *SRS-PosResourceSet*, each ID in the list of reference signal IDs may refer to a reference SS/PBCH block on a serving or non-serving cell indicated by *PCI* field in the activation command, NZP CSI-RS resource configured on serving cell indicated by *Resource Serving Cell ID* field in the activation command if present, same serving cell as the SRS resource set otherwise, SRS resource configured on serving cell and uplink bandwidth part indicated by Resource *Serving Cell ID* field and *Resource BWP ID* field in the activation command if present, same serving cell and bandwidth part as the SRS resource set otherwise, or DL PRS resource of a serving or non-serving cell associated with a *dl-PRS-ID* indicated by *DL-PRS ID* field in the activation command.  - if an SRS resource in the activated resource set is configured with the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos*, the UE shall assume that the ID of the reference signal in the activation command overrides the one configured in *spatialRelationInfo* or *spatialRelationInfoPos.*  - when a UE receives a deactivation command [10, TS 38.321] for an activated SRS resource set, and when the UE would transmit a PUCCH with HARQ-ACK information in slot *n* corresponding to the PDSCH carrying the deactivation command, the corresponding actions in [10, TS 38.321] and UE assumption on cessation of SRS transmission corresponding to the deactivated SRS resource set shall apply starting from the first slot that is after slot where ** is the SCS configuration for the PUCCH.  < Unchanged parts are omitted >  For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter *resourceType* in *SRS-Resource* or *SRS-PosResource* is set to 'aperiodic':  < Unchanged parts are omitted >  - when a UE receives an spatial relation update command, as described in clause 6.1.3.26 of [10, TS 38.321], for an SRS resource configured with the higher layer parameter *SRS-Resource*, and when the HARQ-ACK corresponding to the PDSCH carrying the update command is transmitted in slot *n*, the corresponding actions in [10, TS 38.321] and the UE assumptions on updating spatial relation for the SRS resource shall be applied for SRS transmission starting from the first slot that is after slot where ** is the SCS configuration for the PUCCH. The update command contains spatial relation assumptions provided by a list of references to reference signal IDs, one per element of the updated SRS resource set. Each ID in the list refers to a reference SS/PBCH block, NZP CSI-RS resource configured on serving cell indicated by *Resource Serving Cell ID* field in the update command if present, same serving cell as the SRS resource set otherwise, or SRS resource configured on serving cell and uplink bandwidth part indicated by *Resource* *Serving Cell ID* field and *Resource BWP ID* field in the update command if present, same serving cell and bandwidth part as the SRS resource set otherwise. When the UE is configured with the higher layer parameter *usage* in *SRS-ResourceSet* set to 'antennaSwitching', the UE shall not expect to be configured with different spatial relations for SRS resources in the same SRS resource set.  < Unchanged parts are omitted > |

# R1-2111851

## Background

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| ***Reason for change:*** | In RAN1 #106 meeting, draft CR R1-2108460 was endorsed as an alignment CR, which proposes the following change:  “For the SCell, upon request from higher layers, the UE indicates to higher layers whether there is at least one periodic CSI-RS configuration index or SS/PBCH block index from the set  with corresponding L1-RSRP measurements that are larger than or equal to the Qin,LR threshold, and provides the periodic CSI-RS configuration indexes and/or SS/PBCH block indexes from the set  and the corresponding L1-RSRP measurements that are larger than or equal to the Qin,LR threshold, if any. ”  However, in the formal CR, an additional and unnecessary change is introduced, which changes the second “and/or” into “or”. |
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| ***Summary of change:*** | Remove the unnecessary change, and UE can indicate both SSB and CSI-RS to higher layer. |
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| ***Consequences if not approved:*** | UE behavior on whether it can indiate both SSB and CSI-RS to higher layer for candidate beam detection is not clear. |

## Text Proposal for 38.213

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| **6 Link recovery procedures** <unchanged part omitted>  For the SCell, upon request from higher layers, the UE indicates to higher layers whether there is at least one periodic CSI-RS configuration index or SS/PBCH block index from the set  with corresponding L1-RSRP measurements that are larger than or equal to the Qin,LR threshold, and provides the periodic CSI-RS configuration indexes and/or SS/PBCH block indexes from the set  and the corresponding L1-RSRP measurements that are larger than or equal to the Qin,LR threshold, if any.  <unchanged part omitted> |

# R1-2111672

## Background

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| ***Reason for change:*** | In Rel-16 new antenna port tables Table 7.3.1.2.2-1A/2A/3A/4A are added. They shall be used to schedule NC-JT transmission when at least one codepoint of DCI field ‘Transmission Configuration Indication’ maps to two TCI states. The corresponding change of DCI field “Antenna port(s)” for DCI 1\_1 is captured in 38.212. However, for DCI 1\_2 the discription is still missing. In this draft CR we clarify the mapping table for DCI 1\_2 is Table 7.3.1.2.2-1A/2A/3A/4A when at least one codepoint is activated with 2 TCI states. |
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| ***Summary of change:*** | DCI format 1\_2 uses correct mapping table when codepoint is activated with 2 TCI states. Same text defining the usage of DCI format 1\_1 “Antenna port(s)” field is added to DCI format 1\_2. |
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| ***Consequences if not approved:*** | Wrong table will be used when NC-JT transmission is configured, UE may fail to receive PDSCH. |

## Text Proposal for 38.212

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| 7.3.1.2.3 Format 1\_2 DCI format 1\_2 is used for the scheduling of PDSCH in one cell.  The following information is transmitted by means of the DCI format 1\_2 with CRC scrambled by C-RNTI or CS-RNTI or MCS-C-RNTI:  - Identifier for DCI formats – 1 bits  - The value of this bit field is always set to 1, indicating a DL DCI format.  - Carrier indicator – 0, 1, 2 or 3 bits determined by higher layer parameter *carrierIndicatorSizeDCI-1-2*, as defined in Clause 10.1 of [5, TS38.213].  - Bandwidth part indicator – 0, 1 or 2 bits as determined by the number of DL BWPs configured by higher layers, excluding the initial DL bandwidth part. The bitwidth for this field is determined as bits, where  - if , in which case the bandwidth part indicator is equivalent to the ascending order of the higher layer parameter *BWP-Id*;  - otherwise , in which case the bandwidth part indicator is defined in Table 7.3.1.1.2-1;  If a UE does not support active BWP change via DCI, the UE ignores this bit field.  - Frequency domain resource assignment – number of bits determined by the following:  - bits if only resource allocation type 0 is configured, where is defined in Clause 5.1.2.2.1 of [6, TS 38.214];  - bits if only resource allocation type 1 is configured, or bits if *resourceAllocationDCI-1-2-r16* is configured as '*dynamicSwitch'*, where , is the size of the active DL bandwidth part, is defined as in clause 4.4.4.4 of [4, TS 38.211] and is determined by higher layer parameter *resourceAllocationType1GranularityDCI-1-2*. If the higher layer parameter *resourceAllocationType1GranularityDCI-1-2* is not configured, is equal to 1.  - If *resourceAllocationDCI-1-2-r16* is configured as '*dynamicSwitch'*, the MSB bit is used to indicate resource allocation type 0 or resource allocation type 1, where the bit value of 0 indicates resource allocation type 0 and the bit value of 1 indicates resource allocation type 1.  - For resource allocation type 0, the LSBs provide the resource allocation as defined in Clause 5.1.2.2.1 of [6, TS 38.214].  - For resource allocation type 1, the LSBs provide the resource allocation as defined in Clause 5.1.2.2.2 of [6, TS 38.214]  If "Bandwidth part indicator" field indicates a bandwidth part other than the active bandwidth part and if *resourceAllocationDCI-1-2-r16* is configured as '*dynamicSwitch'* for the indicated bandwidth part, the UE assumes resource allocation type 0 for the indicated bandwidth part if the bitwidth of the "Frequency domain resource assignment" field of the active bandwidth part is smaller than the bitwidth of the "Frequency domain resource assignment" field of the indicated bandwidth part.  - Time domain resource assignment – 0, 1, 2, 3, or 4 bits as defined in Clause 5.1.2.1 of [6, TS 38.214]. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *pdsch-TimeDomainAllocationListDCI-1-2* if the higher layer parameter is configured, or *I* is the number of entries in the higher layer parameter *pdsch-TimeDomainAllocationList* if the higher layer parameter *pdsch-TimeDomainAllocationList* is configured when the higher layer parameter *pdsch-TimeDomainAllocationListDCI-1-2* is not configured; otherwise *I* is the number of entries in the default table.  - VRB-to-PRB mapping – 0 or 1 bit:  - 0 bit if the higher layer parameter *vrb-ToPRB-InterleaverDCI-1-2* is not configured;  - 1 bit according to Table 7.3.1.2.2-5 otherwise, only applicable to resource allocation type 1, as defined in Clause 7.3.1.6 of [4, TS 38.211].  - PRB bundling size indicator – 0 bit if the higher layer parameter *prb-BundlingTypeDCI-1-2* is not configured or is set to 'static', or 1 bit if the higher layer parameter *prb-BundlingTypeDCI-1-2* is set to 'dynamic' according to Clause 5.1.2.3 of [6, TS 38.214].  - Rate matching indicator – 0, 1, or 2 bits according to higher layer parameters *rateMatchPatternGroup1DCI-1-2* and *rateMatchPatternGroup2DCI-1-2*, where the MSB is used to indicate *rateMatchPatternGroup1DCI-1-2* and the LSB is used to indicate *rateMatchPatternGroup2DCI-1-2* when there are two groups.  - ZP CSI-RS trigger – 0, 1, or 2 bits as defined in Clause 5.1.4.2 of [6, TS 38.214]. The bitwidth for this field is determined as bits, where is the number of aperiodic ZP CSI-RS resource sets configured by higher layer parameter *aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2*.  - Modulation and coding scheme – 5 bits as defined in Clause 5.1.3.1 of [6, TS 38.214]  - New data indicator – 1 bit  - Redundancy version – 0, 1 or 2 bits determined by higher layer parameter *numberOfBitsForRV-DCI-1-2*  - If 0 bit is configured, *rvid* to be applied is 0;  - 1 bit according to Table 7.3.1.2.3-1;  - 2 bits according to Table 7.3.1.1.1-2.  - HARQ process number – 0, 1, 2, 3 or 4 bits determined by higher layer parameter *harq-ProcessNumberSizeDCI-1-2*  - Downlink assignment index – 0, 1, 2 or 4 bits  - 0 bit if the higher layer parameter *downlinkAssignmentIndexDCI-1-2* is not configured;  - 1, 2 or 4 bits determined by higher layer parameter *downlinkAssignmentIndexDCI-1-2* otherwise,  - 4 bits if more than one serving cell are configured in the DL and the higher layer parameter *pdsch-HARQ-ACK-Codebook=dynamic*, where the 2 MSB bits are the counter DAI and the 2 LSB bits are the total DAI  - 4 bits if only one serving cell is configured in the DL and the higher layer parameter *pdsch-HARQ-ACK-Codebook=dynamic*, and the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for one or more first CORESETs and is provided *coresetPoolIndex* with value 1 for one or more second CORESETs, and is provided *ackNackFeedbackMode = joint*, where the 2 MSB bits are the counter DAI and the 2 LSB bits are the total DAI.  - 1 or 2 bits if only one serving cell is configured in the DL and the higher layer parameter *pdsch-HARQ-ACK-Codebook=dynamic*, when the UE is not configured with *coresetPoolIndex* or the value of *coresetPoolIndex* is the same for all CORESETs if *coresetPoolIndex* is provided or the UE is not configured with *ackNackFeedbackMode = joint,* where the 1 bit or 2 bits are the counter DAI.  If the UE is configured with a PUCCH-SCell, the number of serving cells is determined within a PUCCH group.  If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-Codebook* is replaced by *pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup-r16* if present for the secondary PUCCH group.  If higher layer parameter *priorityIndicatorDCI-1-2* is configured, if the bit width of the Downlink assignment index in DCI format 1\_2 for one HARQ-ACK codebook is not equal to that of the Downlink assignment index in DCI format 1\_2 for the other HARQ-ACK codebook, a number of most significant bits with value set to '0' are inserted to smaller Downlink assignment index until the bit width of the Downlink assignment index in DCI format 1\_2 for the two HARQ-ACK codebooks are the same.  - TPC command for scheduled PUCCH – 2 bits as defined in Clause 7.2.1 of [5, TS 38.213]  - PUCCH resource indicator – 0 or 1 or 2 or 3 bits determined by higher layer parameter *numberOfBitsForPUCCH-ResourceIndicatorDCI-1-2*  - PDSCH-to-HARQ\_feedback timing indicator – 0, 1, 2, or 3 bits as defined in Clause 9.2.3 of [5, TS 38.213]. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *DL-DataToUL-ACK-DCI-1-2.*  If higher layer parameter *priorityIndicatorDCI-1-2* is configured, if the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_2 for one HARQ-ACK codebook is not equal to that of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_2 for the other HARQ-ACK codebook, a number of most significant bits with value set to '0' are inserted to smaller PDSCH-to-HARQ\_feedback timing indicator until the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_2 for the two HARQ-ACK codebooks are the same.  - Antenna port(s) – 0, 4, 5, or 6 bits  - 0 bit if higher layer parameter *antennaPortsFieldPresenceDCI-1-2* is notconfigured;  - Otherwise 4, 5 or 6 bits as defined by Tables 7.3.1.2.2-1/2/3/4 and Tables 7.3.1.2.2-1A/2A/3A/4A, where the number of CDM groups without data of values 1, 2, and 3 refers to CDM groups {0}, {0,1}, and {0, 1,2} respectively. The antenna ports shall be determined according to the ordering of DMRS port(s) given by Tables 7.3.1.2.2-1/2/3/4 or Tables 7.3.1.2.2-1A/2A/3A/4A. When a UE receives an activation command that maps at least one codepoint of DCI field '*Transmission Configuration Indication*' to two TCI states, the UE shall use Table 7.3.1.2.2-1A/2A/3A/4A; otherwise, it shall use Tables 7.3.1.2.2-1/2/3/4.  If a UE is configured with both *dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* and *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2* andis configured with higher layer parameter *antennaPortsFieldPresenceDCI-1-2*, the bitwidth of this field equals, where is the "Antenna ports" bitwidth derived according to *dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* and is the "Antenna ports" bitwidthderived according to *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2*. A number of zeros are padded in the MSB of this field, if the mapping type of the PDSCH corresponds to the smaller value of and .  If a UE is not configured with higher layer parameter *antennaPortsFieldPresenceDCI-1-2*, antenna port(s) are defined assuming bit field index value 0 in Tables 7.3.1.2.2-1/2/3/4.  - Transmission configuration indication – 0 bit if higher layer parameter *tci-PresentDCI-1-2* is not configured; otherwise 1 or 2 or 3 bits determined by higher layer parameter *tci-PresentDCI-1-2* as defined in Clause 5.1.5 of [6, TS38.214].  If "Bandwidth part indicator" field indicates a bandwidth part other than the active bandwidth part,  - if the higher layer parameter *tci-PresentDCI-1-2* is not configured for the CORESET used for the PDCCH carrying the DCI format 1\_2,  - the UE assumes *tci-PresentDCI-1-2* is not configured for all CORESETs in the indicated bandwidth part;  - otherwise,  - the UE assumes *tci-PresentDCI-1-2* is configured for all CORESETs in the indicated bandwidth part with the same value configured for the CORESET used for the PDCCH carrying the DCI format 1\_2.  - SRS request – 0, 1, 2 or 3 bits  - 0 bit if the higher layer parameter *srs-RequestDCI-1-2* is not configured;  - 1 bit as defined by Table 7.3.1.1.3-1 if the higher layer parameter *srs-RequestDCI-1-2 = 1* and for UEs not configured with *supplementaryUplink* in *ServingCellConfig* in the cell;  - 2 bits if the higher layer parameter *srs-RequestDCI-1-2 = 1* and for UEs configured with *supplementaryUplink* in *ServingCellConfig* in the cell, where the first bit is the non-SUL/SUL indicator as defined in Table 7.3.1.1.1-1 and the second bit is defined by Table 7.3.1.1.3-1;  - 2 bits as defined by Table 7.3.1.1.2-24 if the higher layer parameter *srs-RequestDCI-1-2 = 2* and for UEs not configured with *supplementaryUplink* in *ServingCellConfig* in the cell;  - 3 bits if the higher layer parameter *srs-RequestDCI-1-2 = 2* and for UEs configured with *supplementaryUplink* in *ServingCellConfig* in the cell, where the first bit is the non-SUL/SUL indicator as defined in Table 7.3.1.1.1-1 and the second and third bits are defined by Table 7.3.1.1.2-24;  - DMRS sequence initialization – 0 or 1 bit  - 0 bit if the higher layer parameter *dmrs-SequenceInitializationDCI-1-2* is not configured;  - 1 bit otherwise.  - Priority indicator – 0 bit if higher layer parameter *priorityIndicatorDCI-1-2* is not configured; otherwise 1 bit as defined in Clause 9 in [5, TS 38.213].  If DCI formats 1\_2 are monitored in multiple search spaces associated with multiple CORESETs in a BWP for scheduling the same serving cell, zeros shall be appended until the payload size of the DCI formats 1\_2 monitored in the multiple search spaces equal to the maximum payload size of the DCI format 1\_2 monitored in the multiple search spaces.  Table 7.3.1.2.3-1: Redundancy version   |  |  | | --- | --- | | Value of the Redundancy version field | Value of  to be applied | | 0 | 0 | | 1 | 3 | |

# R1-2111219

## Background

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| ***Reason for change:*** | In Clause 6.3.2.1.2 [TS 38.212], for Type I codebook and Type II codebook, mapping order of CSI fields of one CSI report for CSI Part 2 wideband is given as shown in the following table.  Table 6.3.2.1.2-4: Mapping order of CSI fields of one CSI report, CSI part 2 wideband   |  |  | | --- | --- | | CSI report number | CSI fields | | CSI report #n  CSI part 2 wideband | Wideband CQI for the second TB as in Tables 6.3.1.1.2-3/4/5, if present and reported | | Layer Indicator as in Tables 6.3.1.1.2-3/4/5, if reported | | PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1/2 or 6.3.2.1.2-1/2, if reported | | PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1/2 or 6.3.2.1.2-1/2, or codebook index for 2 antenna ports according to Clause 5.2.2.2.1 in [6, TS38.214], if *pmi-FormatIndicator=* *widebandPMI* and if reported |   It can be observed that layer indicator (LI) and PMI are included in CSI Part 2 if they are reported. However, in Clause 5.2.3 [TS 38.214], Part 2 does not contain LI for Type I and Type II CSI feedback.  For Type I CSI feedback, it is specefied that Part 2 contains PMI (if reported) and contains the CQI for the second codeword (if reported) when RI (if reported) is larger than 4 in Clause 5.2.3 [TS 38.214]. In fact, no matter RI is reported or not, there are always two codewords when RI is larger than 4. Therefore, Part 2 should contain the CQI for the second codeword (if reported) when RI is larger than 4 even if RI is not reported. Hence, the condition in bracket for RI is unnecessary.  For Type II CSI feedback, it is specified that 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, in Clause 5.2.3 [TS 38.214]. There are 2L elements for , and according to the illustration in Caluse 5.2.2.2.3 [TS 38.214]. Hence, their indices *i* should be .  In Clause 6.3.2.1.2 [TS 38.212], the bitwidth of Part 1 for enhanced Type II CSI feedback is calculated according to the following table.  Table 6.3.2.1.2-8: RI and CQI of *codebookType=typeII-r16 or typeII-PortSelection-r16*   |  |  | | --- | --- | | Field | Bitwidth | | Rank Indicator |  | | Wide-band CQI | 4 | | Subband differential CQI | 2 | | Indicator of the total number of non-zero coefficients summed across all layers | if max allowed rank is 1;  otherwise |   where is the number of allowed rank indicator values according to Clauses 5.2.2.2.5 and 5.2.2.2.6 [6, TS 38.214]. The values of the rank indicator field are mapped to allowed rank indicator values with increasing order, where '0' is mapped to the smallest allowed rank indicator value.  When , the bitwidth of rank indicator is zero according to . We can see that index rank indicator is not always reported. However, in Clause 5.2.3 [TS 38.214], for enhanced Type II CSI feedback, it is specified that Part 1 contains RI, CQI, and an indication of the overall number of non-zero amplitude coefficients across layers, which means that Part 1 always includes RI. This also makes UE’s behavior be unclear. |
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| ***Summary of change:*** | Clarified that the contents of Part 1 and/or Part 2 for Type I, Type II,enhanced Type II CSI feedback and corrected the index value of the elements of , and .. |
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| ***Consequences if not approved:*** | UE’s behaviour of CSI reporting for Part 1 and Part 2 is not clear for Type I, Type II and enhanced Type II CSI feedback. The elements of , (if reported) and (if reported) with their indicesi= L,…,2L-1 are not reported. |

## Text Proposal for 38.214

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| 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 and Enhanced Type II 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 and Enhanced Type II 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 and Enhanced Type II 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 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, Part 1 contains RI(if reported), CQI, and an indication of the overall number of non-zero amplitude coefficients across layers for the Enhanced Type II CSI (see Clause 5.2.2.2.5). 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 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', 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* are numbered continuously in increasing order with the lowest subband of *csi-ReportingBand* 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. |

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## Background

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| ***Reason for change:*** | In Tables 5.2.2.2.5-5 and 5.2.2.2.6-2 the vector of FD bases should have a layer subindex because the FD bases are layer specific. |
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| ***Summary of change:*** | In Tables 5.2.2.2.5-5 and 5.2.2.2.6-2 a layer index is missing in . Plus a typo correction in clause 5.2.2.2.6. |
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| ***Consequences if not approved:*** | Notation is inconsistent. |

## Text Proposal for 38.214

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| 5.2.2.2.5 Enhanced Type II Codebook  <omitted text>  Table 5.2.2.2.5-5: Codebook for 1-layer. 2-layer, 3-layer and 4-layer CSI reporting using antenna ports 3000 to 2999+PCSI‑RS   |  |  | | --- | --- | | Layers |  | | |  |  | |  |  | |  |  | |  |  | | Where  and the mappings from to , , , , , , , , and from to , , , , , and , , and are as described above, including the ranges of the constituent indices of and . | |   For coefficients with , amplitude and phase are set to zero, i.e., and .  <omitted text>  5.2.2.2.6 Enhanced Type II Port Selection Codebook  <omitted text>  - The value of is configured as in Clause 5.2.2.2.5.  The UE is also configured with the higher layer bitmap parameter typeII-PortSelectionRI-Restriction-r16, which forms the bit sequence , where is the LSB and is the MSB. When is zero, , PMI and RI reporting are not allowed to correspond to any precoder associated with layers.  <omitted text>  Table 5.2.2.2.6-2: Codebook for 1-layer. 2-layer, 3-layer and 4-layer CSI reporting using antenna ports 3000 to 2999+PCSI‑RS   |  |  | | --- | --- | | Layers |  | | |  |  | |  |  | |  |  | |  |  | | Where ,  and the mappings from to, , , , , and from to , , , , , and , , , and are as described above, including the ranges of the constituent indices of and . | |   For coefficients with , amplitude and phase are set to zero, i.e., and . |