3GPP TSG-RAN WG2 Meeting #123 R2-10xxxxx

Toulouse, France, August, 2023

Agenda Item: 7.20.1

Source: Ericsson

Title: Post 123 MIMOevo RRC

Document for: Discussion, Decision

# Introduction

* [Post123][851][MIMOevo] RRC running CR for MIMO evo (Ericsson)

 **Scope**: Long email discussions after the meeting, to update the RRC running CR for Rel-18 MIMO evo, taking into account a) current noted running CR R2-2308342, b) related contributions to this RAN2 meeting, and c) additional input from R1 (if needed/if any), as well as comments received during this email discussions

 **Intended outcome**: Email discussion report if needed, and updated RRC running CR; can also list some open issues in the email report, as an input to the next step discussions

 Deadline: Long

Sept 22th  Deadline Long Email Discussions. Long email discussions are in normal case expected to start at or after Sept 1st

# Contact Information

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| Ericsson | Helka-Liina Määttänen | Helka-liina.maattanen@ericsson.com |
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# mTRP uTCI

RAN2 has received the L1 parameters in R1-2306271. The running CR captures most of the parameters in R2-2308342 and in R2-2308358 the RAN1 excel with rapporteur comments together with the field name used in the running CR can be found.

#### Parameter *ControlResourceSet*

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| --- | --- | --- | --- | --- | --- |
| RAN2 Parent IE | Parameter name in the spec |  New or existing? | Description | Value range | Comment |
| ControlResourceSet | applyIndicatedTCIState-r18 | New | This parameter is used to inform the UE shall apply the first, the second, both, or none of the indicated joint/DL TCI states to PDCCH reception(s) a CORESET for S-DCI based MTRP operation | {the first, the second, both, none} | From RAN1 perspective, it is up to RAN2 to introduce a new RRC parameter with values {the first, the second, both} and use it along with the legacy parameter followUnifiedTCIstate or introduce a new RRC parameter with values {the first, the second, both, none} without using the legacy parameter followUnifiedTCIstate. |

In Running RRC CR the parameter applyIndicatedTCIState-r18 is implemented as follows in IE ControlResourceSet:

ControlResourceSet ::= SEQUENCE {

 controlResourceSetId ControlResourceSetId,

 frequencyDomainResources BIT STRING (SIZE (45)),

 duration INTEGER (1..maxCoReSetDuration),

 cce-REG-MappingType CHOICE {

 interleaved SEQUENCE {

 reg-BundleSize ENUMERATED {n2, n3, n6},

 interleaverSize ENUMERATED {n2, n3, n6},

 shiftIndex INTEGER(0..maxNrofPhysicalResourceBlocks-1) OPTIONAL -- Need S

 },

 nonInterleaved NULL

 },

 precoderGranularity ENUMERATED {sameAsREG-bundle, allContiguousRBs},

 tci-StatesPDCCH-ToAddList SEQUENCE(SIZE (1..maxNrofTCI-StatesPDCCH)) OF TCI-StateId OPTIONAL, -- Cond NotSIB-initialBWP

 tci-StatesPDCCH-ToReleaseList SEQUENCE(SIZE (1..maxNrofTCI-StatesPDCCH)) OF TCI-StateId OPTIONAL, -- Cond NotSIB-initialBWP

 tci-PresentInDCI ENUMERATED {enabled} OPTIONAL, -- Need S

 pdcch-DMRS-ScramblingID INTEGER (0..65535) OPTIONAL, -- Need S

 ...,

 [[

 rb-Offset-r16 INTEGER (0..5) OPTIONAL, -- Need S

 tci-PresentDCI-1-2-r16 INTEGER (1..3) OPTIONAL, -- Need S

 coresetPoolIndex-r16 INTEGER (0..1) OPTIONAL, -- Need S

 controlResourceSetId-v1610 ControlResourceSetId-v1610 OPTIONAL -- Need S

 ]],

 [[

 followUnifiedTCI-State-r17 ENUMERATED {enabled} OPTIONAL -- Need R

 ]],

 [[

 applyIndicatedTCI-State-r18 ENUMERATED {first, second, both} OPTIONAL -- Cond FollowUTCI

 ]]

}

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| ***ControlResourceSet* field descriptions** |
| ***applyIndicatedTCI-State***This field indicates, for PDCCH reception on this CORESET, if UE applies the first, the second or both "indicated" DL only TCI or joint TCI as specified in TS 38.214 [19], clause 5.1.5. |

|  |  |
| --- | --- |
| **Conditional Presence** | **Explanation** |
| *NotSIB-initialBWP* | The field is absent in *SIB1/SIB20* and in the *PDCCH-ConfigCommon* of the initial BWP in *ServingCellConfigCommon*, if *SIB1/SIB20* is broadcasted. Otherwise, it is optionally present, Need N. |
| *FollowUTCI* | The field is absent if the field *followUnifiedTCI-State* is present. Otherwise, it is optionally present, Need R. |

The implementation assumes that "none" has same meaning as field absent and value “none” is not separately implemented. From code perspective, difference is that if we have value “none” explicitly and the condition FollowUTCI, the UE can never be configured with “none” and the parameter followUnifiedTCI-State present.

**Question 1 Please state if you agree with the above implementation of parameter ControlResourceSet ?**

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| **Company** | **Yes/no** | **Comments** |
| Ericsson | yes |  |
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#### Parameter *applyIndicatedTCIState-r18*  for PUCCH

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| RAN2 Parent IE | Parameter name in the spec |  New or existing? | Description | Value range | Comment |
| PUCCH-Resource and PUCCH-ResourceGroup-r16 | applyIndicatedTCIState-r18 | New | This parameter is used to inform the UE shall apply the first, the second, or both of the indicated joint/UL TCI states to PUCCH transmission(s) corresponding to a PUCCH resource or PUCCH resource group. For M-DCI based MTRP operation, the candidate values can be {the first, the second}, and the first and the second indicated joint/UL TCI states correspond to the indicated joint/UL TCI states specific to coresetPoolIndex value 0 and value 1, respectively.  | {the first, the second, both} | From RAN1 perspective, it is up to RAN2 to introduce a new RRC parameter with values {the first, the second, both} and use it along with the legacy parameter followUnifiedTCIstate or introduce a new RRC parameter with values {the first, the second, both, none} without using the legacy parameter followUnifiedTCIstate. |

The L1 parameter excel asks to enable configuration of the parameter applyIndicatedTCIState-r18 for a PUCCH Resource via the resource itself and additionally via the PUCCH resource group. The implementation enables to configure the parameter applyIndicatedTCIState-r18 for a PUCCH Resource with different values for one UE in one RRC configuration unless additional restrictions are added. This would result in an error case.

1. **One PUCCH resource should not be configured with two different way for applyIndicatedTCIState-r18 operation for one UE in one RRC configuration.**

The intention to enable both per resource and per group configuration seems to be saving of some RRC bits in some possible RRC configurations. It is suggested that RAN2 considers whether it is enough to configure the parameter per resource as that results in simpler and less error prone ASN1 code.

**Question 2 Please state if you agree it is enough to configure the parameter applyIndicatedTCIState-r18 per PUCCH resource?**

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| **Company** | **Yes/no** | **Comments** |
| Ericsson | yes |  |
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#### Parameter *applyIndicatedTCIState-r18* for CSI

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| RAN2 Parent IE | Parameter name in the spec |  New or existing? | Description | Value range | Comment |
| CSI-AssociatedReportConfigInfo | applyIndicatedTCIState-r18 | New | This parameter is used to inform the UE shall apply the first or the second indicated joint/DL TCI states to an aperiodic CSI-RS resource or an aperiodic CSI-RS resource set. For M-DCI based MTRP operation, the first and the second indicated joint/DL TCI states correspond to the indicated joint/DL TCI states specific to coresetPoolIndex value 0 and value 1, respectively.  | {the first, the second} |  |

The parameter applyIndicatedTCIState-r18 is implemented as follows in IE CSI-AssociatedReportConfigInfo:

CSI-AssociatedReportConfigInfo ::= SEQUENCE {

 reportConfigId CSI-ReportConfigId,

 resourcesForChannel CHOICE {

 nzp-CSI-RS SEQUENCE {

 resourceSet INTEGER (1..maxNrofNZP-CSI-RS-ResourceSetsPerConfig),

 qcl-info SEQUENCE (SIZE(1..maxNrofAP-CSI-RS-ResourcesPerSet)) OF TCI-StateId

 OPTIONAL -- Cond Aperiodic

 },

 csi-SSB-ResourceSet INTEGER (1..maxNrofCSI-SSB-ResourceSetsPerConfig)

 },

 csi-IM-ResourcesForInterference INTEGER(1..maxNrofCSI-IM-ResourceSetsPerConfig) OPTIONAL, -- Cond CSI-IM-ForInterference

 nzp-CSI-RS-ResourcesForInterference INTEGER (1..maxNrofNZP-CSI-RS-ResourceSetsPerConfig) OPTIONAL, -- Cond NZP-CSI-RS-ForInterference

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 resourcesForChannel2-r17 CHOICE {

 nzp-CSI-RS2-r17 SEQUENCE {

 resourceSet2-r17 INTEGER (1..maxNrofNZP-CSI-RS-ResourceSetsPerConfig),

 qcl-info2-r17 SEQUENCE (SIZE(1..maxNrofAP-CSI-RS-ResourcesPerSet)) OF TCI-StateId

 OPTIONAL -- Cond Aperiodic

 },

 csi-SSB-ResourceSet2-r17 INTEGER (1..maxNrofCSI-SSB-ResourceSetsPerConfigExt)

 } OPTIONAL, -- Cond NoUnifiedTCI

 csi-SSB-ResourceSetExt INTEGER (1..maxNrofCSI-SSB-ResourceSetsPerConfigExt) OPTIONAL -- Need R

 ]],

 [[

 applyIndicatedTCI-State-r18 ENUMERATED {first, second} OPTIONAL -- Need R

 ]]

}

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| --- |
| *CSI-AssociatedReportConfigInfo* field descriptions |
| ***ap-CSI-MultiplexingMode***Indicates if the behavior of transmitting aperiodic CSI on the first PUSCH repetitions corresponding to two SRS resource sets configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with usage '*codebook*' or '*noncodebook*' is enabled or not. |
| ***applyIndicatedTCI-State***This field indicates, for an aperiodic CSI-RS resource set, if UE applies the first or the second "indicated" DL only TCI or joint TCI as specified in TS 38.214 [19], clause 5.1.5. If the field *coresetPoolIndex* is configured in IE *controlResourceSet* used to schedule the aperiodic CSI-resource set, the value ‘first’ corresponds to the “indicated” joint/UL TCI states specific to *coresetPoolIndex* value 0 and the value ‘second’ correspond to the value 1, respectively.  |

The coresetPoolIndex is per BWP and aperiodic CSI-RS resource is not per BWP as CSI-MeasConfig defined NZP-CSI-RS resources per serving cell. Hence the field description is formulated as “the coreset which is used to schedule the DCI triggering the aperiodic CSI-resource set”.

Further, in R2-2307696 Samsung, a capability related aspect is brought up that UE might support per resource or per resource set indication of applyIndicatedTCIState:

According to the RAN1 agreements, the new UE capability to indicate the supporting the Rel-18 TCI framework for sDCI based mTRP operation on AP CSI-RS. UE indicate whether it supports ‘per CSI-RS resource set’ or ‘per CSI-RS resource’

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| **Agreement in RAN1#113**On unified TCI framework extension for M-DCI based MTRP, an RRC configuration can be provided to an aperiodic CSI-RS resource set or a CSI-RS resource in an aperiodic CSI-RS resource set to inform that the UE shall apply the first or the second indicated joint/DL TCI state to the aperiodic CSI-RS resource set or to the CSI-RS resource in the aperiodic CSI-RS resource set, if the aperiodic CSI-RS resource set for CSI/BM is configured to follow unified TCI state* The first and the second indicated joint/DL TCI states correspond to the indicated joint/DL TCI states specific to *coresetPoolIndex* value 0 and value 1, respectively.
* Above applies at least if the offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources in the aperiodic CSI-RS resource set is equal to or larger than a threshold (if the threshold is needed)
* Support of ‘per CSI-RS resource set’ or ‘per CSI-RS resource’ RRC configuration is up to UE capability
 |

For detail RRC signaling support, RAN2 should consider these aspects. From our understanding, RAN1 suggested the new RRC parameter (*applyIndicatedTCIState-r18)* in *CSI-AssociatedReportConfigInfo* IE [3], it means the new RRC parameter is applied to CSI-RS resource set rather than the CSI-RS resource. In this case, how to handle supporting per CSI-RS resource should be further studied. One option would be configuring the new RRC parameter in both places (csi-SSB-ResourceSet and csi-SSB-Resource).

Hence, different from the excel input which is currently implemented, there is a suggestion to instead configure the parameter in both csi-SSB-ResourceSet and csi-SSB-Resource. However, as the feature is only for aperiodic CSI, the configuration should be specific to AP CSI. One option is to extend the current configuration in IE CSI-AssociatedReportConfigInfo to a list such that it can apply to either the set or each resource individually.

**Question 3 Please state if you agree the above suggested implementation of parameter applyIndicatedTCIState-r18 in IE CSI-AssociatedReportConfigInfo or to extend it as a list?**

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| **Company** | **Answer** | **Comments** |
| Ericsson | Consider extending to a list |  |
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#### Parameter *applyIndicatedTCIState-r18* for SRS

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| RAN2 Parent IE | Parameter name in the spec |  New or existing? | Description | Value range | Comment |
| SRS-ResourceSet | applyIndicatedTCIState-r18 | New | This parameter is used to indicate if [TCI selection field] is present or absent in DCI format 1\_1 and DCI format 1\_2 for a DL BWP | {the first, the second} | When two SRS resource sets for CB/NCB are configured, the UE does not expect the following。 to be configured with the first indicated UL/joint TCI state which is to be applied to the second SRS resource set。 to be configured with the second indicated UL/joint TCI state which is to be applied to the first SRS resource set |

The parameter applyIndicatedTCIState-r18 is implemented in IE SRS-ResourceSet following the excel. The excel did not indicate any relation with this parameter and the followUnifiedTCI-StateSRS and hence none is implemented. There may be some doubt whether there is actually a need to specify a relation between these two parameters.

**Question 4 Please state if you think there is a need to specify relation the parameter applyIndicatedTCIState-r18 and the followUnifiedTCI-StateSRS in IE SRS-ResourceSet?**

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| **Company** | **Yes/no** | **Comments** |
| Ericsson | No(?) |  |
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# CSI-CJT

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| RAN2 Parent IE | Parameter name in the spec |  New or existing? | Description | Value range | Comment |
| CSI-ReportConfig | numberOfSDCombinations | New | N\_L: Number of combinations for (L1,L2,…,LNTRP) | 1,2,4 | May not be needed and, depending on RAN2 design, can be inferred from the {Ln} list |
| CSI-ReportConfig | numberOfSDCombinations-PS | New | N\_L: Number of combinations for (alpha1,alpha2,…,alphaNTRP) | 1,2,4 | May not be needed and, depending on RAN2 design, can be inferred from the {alphan} list |

**Question 4 Please state if you agree that values for numberOfSDCombinations and numberOfSDCombinations-PS can be derived from list size paramCombination-CJT-L-r18 or paramCombination-CJT-PS-aplha-r18?**

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| **Company** | **Yes/no** | **Comments** |
| Ericsson | Yes |  |
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# CSI-TDCP

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| RAN2 Parent IE | Parameter name in the spec |  New or existing? | Description | Value range | Comment |
| CSI-ReportConfig | Y | New |   | 1,2,3,4 |  |
| CSI-ReportConfig | phase | New | Phase reporting | {ON,OFF} |  |
| CSI-ReportConfig | D | New | delay value(s) for Y delay/lag valuesCandidate values for a given delay: 4 symbols, 1,2,3,4,5,6,10 slotsNote: D=10 slots is only applicable to SCS >=30kHz  | [{D1,…,DY}] | [113] AgreementFor the Rel-18 TRS-based TDCP reporting, for a configured value of Y and a set of configured delay values {D1, …, DY}, for the n-th delay Dn (n=1, …, Y), the respective TDCP calculation is defined as wideband normalized correlation between two TRS symbols separated by Dn symbols |

In Running RRC CR the following is implemented:

####

#### – *CSI-ReportConfig*

The IE *CSI-ReportConfig* is used to configure a periodic or semi-persistent report sent on PUCCH on the cell in which the *CSI-ReportConfig* is included, or to configure a semi-persistent or aperiodic report sent on PUSCH triggered by DCI received on the cell in which the *CSI-ReportConfig* is included (in this case, the cell on which the report is sent is determined by the received DCI). See TS 38.214 [19], clause 5.2.1.

*CSI-ReportConfig* information element

-- ASN1START

-- TAG-CSI-REPORTCONFIG-START

CSI-ReportConfig ::= SEQUENCE {

 reportConfigId CSI-ReportConfigId,

 carrier ServCellIndex OPTIONAL, -- Need S

 resourcesForChannelMeasurement CSI-ResourceConfigId,

 csi-IM-ResourcesForInterference CSI-ResourceConfigId OPTIONAL, -- Need R

 nzp-CSI-RS-ResourcesForInterference CSI-ResourceConfigId OPTIONAL, -- Need R

 reportConfigType CHOICE {

 periodic SEQUENCE {

 reportSlotConfig CSI-ReportPeriodicityAndOffset,

 pucch-CSI-ResourceList SEQUENCE (SIZE (1..maxNrofBWPs)) OF PUCCH-CSI-Resource

 },

 semiPersistentOnPUCCH SEQUENCE {

 reportSlotConfig CSI-ReportPeriodicityAndOffset,

 pucch-CSI-ResourceList SEQUENCE (SIZE (1..maxNrofBWPs)) OF PUCCH-CSI-Resource

 },

 semiPersistentOnPUSCH SEQUENCE {

 reportSlotConfig ENUMERATED {sl5, sl10, sl20, sl40, sl80, sl160, sl320},

 reportSlotOffsetList SEQUENCE (SIZE (1.. maxNrofUL-Allocations)) OF INTEGER(0..32),

 p0alpha P0-PUSCH-AlphaSetId

 },

 aperiodic SEQUENCE {

 reportSlotOffsetList SEQUENCE (SIZE (1..maxNrofUL-Allocations)) OF INTEGER(0..32)

 }

 },

 reportQuantity CHOICE {

 none NULL,

 cri-RI-PMI-CQI NULL,

 cri-RI-i1 NULL,

 cri-RI-i1-CQI SEQUENCE {

 pdsch-BundleSizeForCSI ENUMERATED {n2, n4} OPTIONAL -- Need S

 },

 cri-RI-CQI NULL,

 cri-RSRP NULL,

 ssb-Index-RSRP NULL,

 cri-RI-LI-PMI-CQI NULL

 },

 reportFreqConfiguration SEQUENCE {

 cqi-FormatIndicator ENUMERATED { widebandCQI, subbandCQI } OPTIONAL, -- Need R

 pmi-FormatIndicator ENUMERATED { widebandPMI, subbandPMI } OPTIONAL, -- Need R

 csi-ReportingBand CHOICE {

 subbands3 BIT STRING(SIZE(3)),

 subbands4 BIT STRING(SIZE(4)),

 subbands5 BIT STRING(SIZE(5)),

 subbands6 BIT STRING(SIZE(6)),

 subbands7 BIT STRING(SIZE(7)),

 subbands8 BIT STRING(SIZE(8)),

 subbands9 BIT STRING(SIZE(9)),

 subbands10 BIT STRING(SIZE(10)),

 subbands11 BIT STRING(SIZE(11)),

 subbands12 BIT STRING(SIZE(12)),

 subbands13 BIT STRING(SIZE(13)),

 subbands14 BIT STRING(SIZE(14)),

 subbands15 BIT STRING(SIZE(15)),

 subbands16 BIT STRING(SIZE(16)),

 subbands17 BIT STRING(SIZE(17)),

 subbands18 BIT STRING(SIZE(18)),

 ...,

 subbands19-v1530 BIT STRING(SIZE(19))

 } OPTIONAL -- Need S

 } OPTIONAL, -- Need R

 timeRestrictionForChannelMeasurements ENUMERATED {configured, notConfigured},

 timeRestrictionForInterferenceMeasurements ENUMERATED {configured, notConfigured},

 codebookConfig CodebookConfig OPTIONAL, -- Need R

 dummy ENUMERATED {n1, n2} OPTIONAL, -- Need R

 groupBasedBeamReporting CHOICE {

 enabled NULL,

 disabled SEQUENCE {

 nrofReportedRS ENUMERATED {n1, n2, n3, n4} OPTIONAL -- Need S

 }

 },

 cqi-Table ENUMERATED {table1, table2, table3, table4-r17} OPTIONAL, -- Need R

 subbandSize ENUMERATED {value1, value2},

 non-PMI-PortIndication SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerConfig)) OF PortIndexFor8Ranks OPTIONAL, -- Need R

 ...,

 [[

 semiPersistentOnPUSCH-v1530 SEQUENCE {

 reportSlotConfig-v1530 ENUMERATED {sl4, sl8, sl16}

 } OPTIONAL -- Need R

 ]],

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 semiPersistentOnPUSCH-v1610 SEQUENCE {

 reportSlotOffsetListDCI-0-2-r16 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32) OPTIONAL, -- Need R

 reportSlotOffsetListDCI-0-1-r16 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32) OPTIONAL -- Need R

 } OPTIONAL, -- Need R

 aperiodic-v1610 SEQUENCE {

 reportSlotOffsetListDCI-0-2-r16 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32) OPTIONAL, -- Need R

 reportSlotOffsetListDCI-0-1-r16 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32) OPTIONAL -- Need R

 } OPTIONAL, -- Need R

 reportQuantity-r16 CHOICE {

 cri-SINR-r16 NULL,

 ssb-Index-SINR-r16 NULL

 } OPTIONAL, -- Need R

 codebookConfig-r16 CodebookConfig-r16 OPTIONAL -- Need R

 ]],

 [[

 cqi-BitsPerSubband-r17 ENUMERATED {bits4} OPTIONAL, -- Need R

 groupBasedBeamReporting-v1710 SEQUENCE {

 nrofReportedGroups-r17 ENUMERATED {n1, n2, n3, n4}

 } OPTIONAL, -- Need R

 codebookConfig-r17 CodebookConfig-r17 OPTIONAL, -- Need R

 sharedCMR-r17 ENUMERATED {enable} OPTIONAL, -- Need R

 csi-ReportMode-r17 ENUMERATED {mode1, mode2} OPTIONAL, -- Need R

 numberOfSingleTRP-CSI-Mode1-r17 ENUMERATED {n0, n1, n2} OPTIONAL, -- Need R

 reportQuantity-r17 CHOICE {

 cri-RSRP-Index-r17 NULL,

 ssb-Index-RSRP-Index-r17 NULL,

 cri-SINR-Index-r17 NULL,

 ssb-Index-SINR-Index-r17 NULL

 } OPTIONAL -- Need R

 ]],

 [[

 semiPersistentOnPUSCH-v1720 SEQUENCE {

 reportSlotOffsetList-r17 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..128) OPTIONAL, -- Need R

 reportSlotOffsetListDCI-0-2-r17 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..128) OPTIONAL, -- Need R

 reportSlotOffsetListDCI-0-1-r17 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..128) OPTIONAL -- Need R

 } OPTIONAL, -- Need R

 aperiodic-v1720 SEQUENCE {

 reportSlotOffsetList-r17 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..128) OPTIONAL, -- Need R

 reportSlotOffsetListDCI-0-2-r17 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..128) OPTIONAL, -- Need R

 reportSlotOffsetListDCI-0-1-r17 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..128) OPTIONAL -- Need R

 } OPTIONAL -- Need R

 ]],

 [[

 codebookConfig-v1730 CodebookConfig-v1730 OPTIONAL -- Need R

 ]],

 [[

 groupBasedBeamReporting-r18 SEQUENCE {

 nrofReportedGroups-r18 ENUMERATED {n1, n2, n3, n4}

 } OPTIONAL, -- Need R

 reportQuantity-r18 TDCP-r18 OPTIONAL, -- Need R

 codebookConfig-r18 CodebookConfig-r18 OPTIONAL -- Need R

 ]]

}

CSI-ReportPeriodicityAndOffset ::= CHOICE {

 slots4 INTEGER(0..3),

 slots5 INTEGER(0..4),

 slots8 INTEGER(0..7),

 slots10 INTEGER(0..9),

 slots16 INTEGER(0..15),

 slots20 INTEGER(0..19),

 slots40 INTEGER(0..39),

 slots80 INTEGER(0..79),

 slots160 INTEGER(0..159),

 slots320 INTEGER(0..319)

}

PUCCH-CSI-Resource ::= SEQUENCE {

 uplinkBandwidthPartId BWP-Id,

 pucch-Resource PUCCH-ResourceId

}

PortIndexFor8Ranks ::= CHOICE {

 portIndex8 SEQUENCE{

 rank1-8 PortIndex8 OPTIONAL, -- Need R

 rank2-8 SEQUENCE(SIZE(2)) OF PortIndex8 OPTIONAL, -- Need R

 rank3-8 SEQUENCE(SIZE(3)) OF PortIndex8 OPTIONAL, -- Need R

 rank4-8 SEQUENCE(SIZE(4)) OF PortIndex8 OPTIONAL, -- Need R

 rank5-8 SEQUENCE(SIZE(5)) OF PortIndex8 OPTIONAL, -- Need R

 rank6-8 SEQUENCE(SIZE(6)) OF PortIndex8 OPTIONAL, -- Need R

 rank7-8 SEQUENCE(SIZE(7)) OF PortIndex8 OPTIONAL, -- Need R

 rank8-8 SEQUENCE(SIZE(8)) OF PortIndex8 OPTIONAL -- Need R

 },

 portIndex4 SEQUENCE{

 rank1-4 PortIndex4 OPTIONAL, -- Need R

 rank2-4 SEQUENCE(SIZE(2)) OF PortIndex4 OPTIONAL, -- Need R

 rank3-4 SEQUENCE(SIZE(3)) OF PortIndex4 OPTIONAL, -- Need R

 rank4-4 SEQUENCE(SIZE(4)) OF PortIndex4 OPTIONAL -- Need R

 },

 portIndex2 SEQUENCE{

 rank1-2 PortIndex2 OPTIONAL, -- Need R

 rank2-2 SEQUENCE(SIZE(2)) OF PortIndex2 OPTIONAL -- Need R

 },

 portIndex1 NULL

}

PortIndex8::= INTEGER (0..7)

PortIndex4::= INTEGER (0..3)

PortIndex2::= INTEGER (0..1)

TDCP-r18 ::= SEQUENCE {

 delayDSetofLenghtY-r18 SEQUENCE (SIZE (1.. maxNrofdelayD-r18)) OF DelayD,

 phaseReporting-r18 ENUMERATED {enable} OPTIONAL -- Need R

}

DelayD ::= ENUMERATED { symb4, slot1, slot2, slot3, slot4, slot5, slot6, slot10 }

-- TAG-CSI-REPORTCONFIG-STOP

-- ASN1STOP

|  |
| --- |
| *TDCP* field descriptions |
| ***delayDSetofLenghtY***Configures a set of Y delay values for TDCP reporting, see reference XXX. The symb4 denotes 4 symbols, the slot1 denotes 1 slot, the slot2 denotes 2 slots and so on. The value slot 10 is applicable only to SCS >=30kHz. The parameter Y, see reference XXX, is given by the length of the set of D values. |
| ***phaseReporting*** Configures the UE for phase reporting for TDCP reporting see reference XXX. |

Seems that the value of Y can be deferred from the list length of delayDSetofLenghtY-r18.

**Question 5 Please state if you agree to jointly encode parameters Y and D?**

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| --- | --- | --- |
| **Company** | **Yes/no** | **Comments** |
| Ericsson | yes |  |
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# CSI-Doppler

In R2-2307696 Samsung, it is suggested to encode parameters d and m together:

For high/medium speed UE, UE-side CSI prediction and reporting of time-domain channel properties is introduced as one of the CSI enhancements. The RRC parameters *d* and *m* for AP CSI-RS resource for CSI prediction are copied below followed with description in TS38.214 CR [4].

  

|  |
| --- |
| Subject to UE capability, a UE configured with a *CSI-ReportConfig* with the higher layer parameter *N4* and *reportQuantity* set to 'cri-RI-PMI-CQI' is assumed to support UE-side CSI prediction. The reported PMI indicates predicted precoder matrices associated with $N\_{4}$ consecutive slot intervals, each with duration of $d$ slots, where the value of $N\_{4}\in \{1,2,4,8\}$ is configured by *N4*. If the UE is configured with an aperiodic CSI-RS resource set for channel measurement, the value, in number of slots, of the time unit $d\in \{1,m\}$ is configured by higher layer parameter *d*, where $m$ is defined in Clause 5.2.1.4.1. If the UE is configured with a periodic or semi-persistent CSI-RS resource set for channel measurement, the value of $d$ is equal to the periodicity of the CSI-RS resource. The earliest of the $N\_{4}$ slot intervals starts at slot $l=n+δ$, where $n$ is the uplink slot in which the CSI is reported and the slot offset $δ$ is configured by higher layer parameter *delta*.…A UE configured with a *CSI-ReportConfig* with the higher layer parameter *N4* and *reportQuantity* set to 'cri-RI-PMI-CQI', is expected to be configured with $K\in \{4,8,12\}$ aperiodic CSI-RS resources or with a single periodic or semi-persistent CSI-RS resource in the resource set for channel measurement. For an aperiodic CSI-RS resource set for channel measurement, the $K$ CSI-RS resources are triggered by the same triggering instance and the separation between two consecutive CSI-RS resources is $m\in \{1,2\}$ slots, which is configured by higher layer parameter in the *NZP-CSI-RS-ResourceSet*. The UE shall assume that the antenna port with the same port index of the $K$ aperiodic CSI-RS resources is the same. If interference measurement is performed on CSI-IM, only one resource is configured in the corresponding *csi-IM-ResourceSet*. |

Based on the description, *d* is the length of a slot interval, during which UE predicts CSI, and *m* is the separation between 2 consecutive AP CSI-RS resource, where $d\in \{1,m\}$ and $m\in \{1,2\}$ slots. Since *d* and *m* are coupled, one parameter can be introduced to configure values of the two, i.e., *d-m* with values {1-1, 1-2, 2-2}.

**Proposal 6: For CSI-Doppler, one parameter *d-m* is used to configure values of *d* and *m*, i.e., *d-m* with values {1-1, 1-2, 2-2}.**

The running RRC CR implements currently the parameter d as unitDurationDD-r18 in IE CodebookConfig-r18 under typeII-Doppler-r18 and parameter m as aperiodicResourceOffset-r18 in IE NZP-CSI-RS-ResourceSet.

**Question 6 Please state whether to jointly configure parameters d and m and in which IE those should be placed(whether separate or jointly coded)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **Comments** |
| Ericsson | As in running CR | Open to change after further checking/majority view |
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# UL codebook

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| --- | --- | --- | --- | --- | --- |
| RAN2 Parent IE | Parameter name in the spec |  New or existing? | Description | Value range | Comment |
| PUSCH-Config | ULcodebookFC-N1N2 | New | Supported combination of a pair of parameters (N1, N2Only applicable to CodebookType='Codebook1' | (4,1), (2,2) | Whether ULcodebookFC-N1N2 and CodebookType are merged or not is up to RAN2 |
| PUSCH-Config | CodebookType | New | Codebook typeCodebook1 corresponds to Ng=1Codebook2 corresponds to Ng=2Codebook3 corresponds to Ng=4Codebook4 corresponds to Ng=8Ng represents the number of antenna port-groups | {Codebook1, Codebook2, Codebook3, Codebook4} | This is an example.The details are up to RAN2Whether ULcodebookFC-N1N2 and CodebookType are merged or not is up to RAN2 |

In Running RRC CR the following is implemented:

#### – *PUSCH-Config*

The IE *PUSCH-Config* is used to configure the UE specific PUSCH parameters applicable to a particular BWP.

*PUSCH-Config* information element

-- ASN1START

-- TAG-PUSCH-CONFIG-START

PUSCH-Config ::= SEQUENCE {

\*\*\*\*fields omitted\*\*\*\*

]]

 codebookTypeUL-r18 SetupRelease { CodebookTypeUL-r18 } OPTIONAL -- Need M

 ]]

}

\*\*\*\*fields omitted\*\*\*\*

CodebookTypeUL-r18 ::= CHOICE {

 codebook1-r18 ENUMERATED {ng1n4n1, ng1n2n2}

 codebook1-r18 ENUMERATED {ng2}

 codebook2-r18 ENUMERATED {ng4}

 codebook3-r18 ENUMERATED {ng8}

}

**Question 7 Please state whether you agree with the current implementation of UL codebook?**

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| --- | --- | --- |
| **Company** | **Yes/no** | **Comments** |
| Ericsson | yes |  |
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# CodebookConfig-r18

In Running RRC CR the following is implemented:

1. – *CodebookConfig*

The IE *CodebookConfig* is used to configure codebooks of Type-I and Type-II (see TS 38.214 [19], clause 5.2.2.2)

1. ***CodebookConfig* information element**

-- ASN1START

-- TAG-CODEBOOKCONFIG-START

CodebookConfig ::= SEQUENCE {

 codebookType CHOICE {

 type1 SEQUENCE {

 subType CHOICE {

 typeI-SinglePanel SEQUENCE {

 nrOfAntennaPorts CHOICE {

 two SEQUENCE {

 twoTX-CodebookSubsetRestriction BIT STRING (SIZE (6))

 },

 moreThanTwo SEQUENCE {

 n1-n2 CHOICE {

 two-one-TypeI-SinglePanel-Restriction BIT STRING (SIZE (8)),

 two-two-TypeI-SinglePanel-Restriction BIT STRING (SIZE (64)),

 four-one-TypeI-SinglePanel-Restriction BIT STRING (SIZE (16)),

 three-two-TypeI-SinglePanel-Restriction BIT STRING (SIZE (96)),

 six-one-TypeI-SinglePanel-Restriction BIT STRING (SIZE (24)),

 four-two-TypeI-SinglePanel-Restriction BIT STRING (SIZE (128)),

 eight-one-TypeI-SinglePanel-Restriction BIT STRING (SIZE (32)),

 four-three-TypeI-SinglePanel-Restriction BIT STRING (SIZE (192)),

 six-two-TypeI-SinglePanel-Restriction BIT STRING (SIZE (192)),

 twelve-one-TypeI-SinglePanel-Restriction BIT STRING (SIZE (48)),

 four-four-TypeI-SinglePanel-Restriction BIT STRING (SIZE (256)),

 eight-two-TypeI-SinglePanel-Restriction BIT STRING (SIZE (256)),

 sixteen-one-TypeI-SinglePanel-Restriction BIT STRING (SIZE (64))

 },

 typeI-SinglePanel-codebookSubsetRestriction-i2 BIT STRING (SIZE (16)) OPTIONAL -- Need R

 }

 },

 typeI-SinglePanel-ri-Restriction BIT STRING (SIZE (8))

 },

 typeI-MultiPanel SEQUENCE {

 ng-n1-n2 CHOICE {

 two-two-one-TypeI-MultiPanel-Restriction BIT STRING (SIZE (8)),

 two-four-one-TypeI-MultiPanel-Restriction BIT STRING (SIZE (16)),

 four-two-one-TypeI-MultiPanel-Restriction BIT STRING (SIZE (8)),

 two-two-two-TypeI-MultiPanel-Restriction BIT STRING (SIZE (64)),

 two-eight-one-TypeI-MultiPanel-Restriction BIT STRING (SIZE (32)),

 four-four-one-TypeI-MultiPanel-Restriction BIT STRING (SIZE (16)),

 two-four-two-TypeI-MultiPanel-Restriction BIT STRING (SIZE (128)),

 four-two-two-TypeI-MultiPanel-Restriction BIT STRING (SIZE (64))

 },

 ri-Restriction BIT STRING (SIZE (4))

 }

 },

 codebookMode INTEGER (1..2)

 },

 type2 SEQUENCE {

 subType CHOICE {

 typeII SEQUENCE {

 n1-n2-codebookSubsetRestriction CHOICE {

 two-one BIT STRING (SIZE (16)),

 two-two BIT STRING (SIZE (43)),

 four-one BIT STRING (SIZE (32)),

 three-two BIT STRING (SIZE (59)),

 six-one BIT STRING (SIZE (48)),

 four-two BIT STRING (SIZE (75)),

 eight-one BIT STRING (SIZE (64)),

 four-three BIT STRING (SIZE (107)),

 six-two BIT STRING (SIZE (107)),

 twelve-one BIT STRING (SIZE (96)),

 four-four BIT STRING (SIZE (139)),

 eight-two BIT STRING (SIZE (139)),

 sixteen-one BIT STRING (SIZE (128))

 },

 typeII-RI-Restriction BIT STRING (SIZE (2))

 },

 typeII-PortSelection SEQUENCE {

 portSelectionSamplingSize ENUMERATED {n1, n2, n3, n4} OPTIONAL, -- Need R

 typeII-PortSelectionRI-Restriction BIT STRING (SIZE (2))

 }

 },

 phaseAlphabetSize ENUMERATED {n4, n8},

 subbandAmplitude BOOLEAN,

 numberOfBeams ENUMERATED {two, three, four}

 }

 }

}

CodebookConfig-r16 ::= SEQUENCE {

 codebookType CHOICE {

 type2 SEQUENCE {

 subType CHOICE {

 typeII-r16 SEQUENCE {

 n1-n2-codebookSubsetRestriction-r16 CHOICE {

 two-one BIT STRING (SIZE (16)),

 two-two BIT STRING (SIZE (43)),

 four-one BIT STRING (SIZE (32)),

 three-two BIT STRING (SIZE (59)),

 six-one BIT STRING (SIZE (48)),

 four-two BIT STRING (SIZE (75)),

 eight-one BIT STRING (SIZE (64)),

 four-three BIT STRING (SIZE (107)),

 six-two BIT STRING (SIZE (107)),

 twelve-one BIT STRING (SIZE (96)),

 four-four BIT STRING (SIZE (139)),

 eight-two BIT STRING (SIZE (139)),

 sixteen-one BIT STRING (SIZE (128))

 },

 typeII-RI-Restriction-r16 BIT STRING (SIZE(4))

 },

 typeII-PortSelection-r16 SEQUENCE {

 portSelectionSamplingSize-r16 ENUMERATED {n1, n2, n3, n4},

 typeII-PortSelectionRI-Restriction-r16 BIT STRING (SIZE (4))

 }

 },

 numberOfPMI-SubbandsPerCQI-Subband-r16 INTEGER (1..2),

 paramCombination-r16 INTEGER (1..8)

 }

 }

}

CodebookConfig-r17 ::= SEQUENCE {

 codebookType CHOICE {

 type1 SEQUENCE {

 typeI-SinglePanel-Group1-r17 SEQUENCE {

 nrOfAntennaPorts CHOICE {

 two SEQUENCE {

 twoTX-CodebookSubsetRestriction1-r17 BIT STRING (SIZE (6))

 },

 moreThanTwo SEQUENCE {

 n1-n2 CHOICE {

 two-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (8)),

 two-two-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (64)),

 four-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (16)),

 three-two-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (96)),

 six-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (24)),

 four-two-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (128)),

 eight-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (32)),

 four-three-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (192)),

 six-two-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (192)),

 twelve-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (48)),

 four-four-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (256)),

 eight-two-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (256)),

 sixteen-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (64))

 }

 }

 }

 } OPTIONAL, -- Need R

 typeI-SinglePanel-Group2-r17 SEQUENCE {

 nrOfAntennaPorts CHOICE {

 two SEQUENCE {

 twoTX-CodebookSubsetRestriction2-r17 BIT STRING (SIZE (6))

 },

 moreThanTwo SEQUENCE {

 n1-n2 CHOICE {

 two-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (8)),

 two-two-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (64)),

 four-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (16)),

 three-two-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (96)),

 six-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (24)),

 four-two-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (128)),

 eight-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (32)),

 four-three-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (192)),

 six-two-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (192)),

 twelve-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (48)),

 four-four-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (256)),

 eight-two-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (256)),

 sixteen-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (64))

 }

 }

 }

 } OPTIONAL, -- Need R

 typeI-SinglePanel-ri-RestrictionSTRP-r17 BIT STRING (SIZE (8)) OPTIONAL, -- Need R

 typeI-SinglePanel-ri-RestrictionSDM-r17 BIT STRING (SIZE (4)) OPTIONAL -- Need R

 },

 type2 SEQUENCE {

 typeII-PortSelection-r17 SEQUENCE {

 paramCombination-r17 INTEGER (1..8),

 valueOfN-r17 ENUMERATED {n2, n4} OPTIONAL, -- Need R

 numberOfPMI-SubbandsPerCQI-Subband-r17 INTEGER(1..2) OPTIONAL, -- Need R

 typeII-PortSelectionRI-Restriction-r17 BIT STRING (SIZE (4))

 }

 }

 }

}

CodebookConfig-v1730 ::= SEQUENCE {

 codebookType CHOICE {

 type1 SEQUENCE {

 codebookMode INTEGER (1..2) OPTIONAL -- Need R

 }

 }

}

CodebookConfig-r18 ::= SEQUENCE {

 codebookType CHOICE {

 type2 SEQUENCE {

 typeII-CJT-r18 SEQUENCE { numberOfCMR-r18 INTEGER (1..4),

 n1-n2-codebookSubsetRestrictionList-r18 SEQUENCE (SIZE (1..4)) OF CBSR-r18 OPTIONAL, -- Need R

 paramCombination-CJT-r18 INTEGER (1..7),

 paramCombination-CJT-L-r18 SEQUENCE (SIZE (1..4)) OF INTEGER (1-16) OPTIONAL, -- Need R

 restrictedCMR-Selection-r18 ENUMERATED {enable} OPTIONAL, -- Need R

 valueOfO3-r18 ENUMERATED {n1, n4} OPTIONAL, -- Need R

 numberOfPMI-SubbandsPerCQI-Subband-r18 INTEGER(1..2) OPTIONAL, -- Need R

 typeII-RI-Restriction-r18 BIT STRING (SIZE (4))

 }

 typeII-CJT-PortSelection-r18 SEQUENCE {

 paramCombination-CJT-PS-r18 INTEGER (1..5),

 paramCombination-CJT-PS-alpha-r18 SEQUENCE (SIZE (1..4)) OF INTEGER (1-20) OPTIONAL, -- Need R

 valueOfO3-r18 ENUMERATED {n1, n4} OPTIONAL, -- Need R

 valueOfN-CJT-r18 ENUMERATED {n2, n4} OPTIONAL, -- Need R

 numberOfPMI-SubbandsPerCQI-Subband-r18 INTEGER(1..2) OPTIONAL, -- Need R

 typeII-PortSelectionRI-Restriction-r18 BIT STRING (SIZE (4))

 }

 typeII-Doppler-r18 SEQUENCE {

 n1-n2-codebookSubsetRestriction-r18 CBSR-r18,

 paramCombination-Doppler-r18 INTEGER (1..9),

 td-dd-config-r18 TD-DD-Config-r18 OPTIONAL, -- Need R

 numberOfPMI-SubbandsPerCQI-Subband-r18 INTEGER(1..2) OPTIONAL, -- Need R

 predictionDelay-r18 ENUMERATED {m0,n0,n1,n2 } OPTIONAL, -- Need R

 typeII-RI-Restriction-r18 BIT STRING (SIZE (4))

 }

 typeII-DopplerPortSelection-r18 SEQUENCE {

 paramCombinationDoppler-PS-r18 INTEGER (1..8),

 valueOfN-Doppler-r18 ENUMERATED {n2, n4} OPTIONAL, -- Need R

 numberOfPMI-SubbandsPerCQI-Subband-r18 INTEGER(1..2) OPTIONAL, -- Need R

 predictionDelay-r18 ENUMERATED {m0,n0,n1,n2 } OPTIONAL, -- Need R

 typeII-PortSelectionRI-Restriction-r18 BIT STRING (SIZE (4))

 }

 }

 }

 codebookMode-r18 INTEGER (1..2) OPTIONAL -- Need R

}

CBSR-r18 ::= CHOICE {

 two-one BIT STRING (SIZE (16)),

 two-two BIT STRING (SIZE (43)),

 four-one BIT STRING (SIZE (32)),

 three-two BIT STRING (SIZE (59)),

 six-one BIT STRING (SIZE (48)),

 four-two BIT STRING (SIZE (75)),

 eight-one BIT STRING (SIZE (64)),

 four-three BIT STRING (SIZE (107)),

 six-two BIT STRING (SIZE (107)),

 twelve-one BIT STRING (SIZE (96)),

 four-four BIT STRING (SIZE (139)),

 eight-two BIT STRING (SIZE (139)),

 sixteen-one BIT STRING (SIZE (128))

}

TD-DD-Config-r18 ::= SEQUENCE {

 vectorLengthDD-r18 ENUMERATED {n1,n2,n4,n8 }

 unitDurationDD-r18 ENUMERATED {n1,nm} OPTIONAL, -- Need R

 tdCQI-r18 ENUMERATED {n11,n12,n2 } OPTIONAL -- Need R

}

-- TAG-CODEBOOKCONFIG-STOP

-- ASN1STOP

**Question 8 Please indicate whether you agree that CodebookConfig is critically extended? If not, please give alternative ASN1 code. (also if you have other ASN1 alternative suggestions for this part, you may give it here)**

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| --- | --- | --- |
| **Company** | **Yes/no** | **ASN1 alternative** |
| Ericsson | yes |  |
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# Other

**Question 9 Please indicate any other comments for running CR review?**

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| --- | --- | --- |
| **Company** | **Topic/parameter** | **Comments** |
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