**3GPP TSG-RAN WG2 Meeting #101 *R2-180xxxx***

**Athens, Greece, 26th February - 2nd March 2018**

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| *CR-Form-v11.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.331** | **CR** | **CRNum** | **rev** | **-** | **Current version:** | **15.0.1** |  |
|  | | | | | | | | |
| *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:*** | Corrections on EN-DC - CSI L1 parameters | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** |  | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_newRAT-Core | | | | |  | | ***Date:*** | | 2018-02-05 |
|  |  | | | |  | | |  | |  |
| ***Category:*** | **F** |  | | | | | | ***Release:*** | | Rel-15 |
|  | *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-12 (Release 12) Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Corrections identified during ASN.1 review (RAN2 NR AH 1801), and email discussions after the AH.  This CR is based on  R2-1801218 Baseline TS 38331 v1.0.1 for ASN.1 review | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | To be completed.  Guidance for CR editors:   1. To avoid change marks for language formatting (typically happens when many users edit the same doc), please do the following word setting:   Review panel => Language => Set proofing languge => Detect automatically => OFF   1. Set the “User name” to indicate the company name. 2. When storing the CR in 3GPP folder, companies should add their Company ID (one letter) to the file name (see RIL). | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | |  | | | |
| ***Other specs*** | |  |  | Other core specifications | | | TS/TR ... CR ... | | | |
| ***affected:*** | |  |  | Test specifications | | | TS/TR ... CR ... | | | |
| ***(show related CRs)*** | |  |  | O&M Specifications | | | TS/TR ... CR ... | | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |

### 6.3.2 Radio resource control information elements

[AdditionalSpectrumEmission, Alpha, ARFCN-ValueNR, BandwidthPart-Config, BeamFailureDetectionConfig, BeamFailureRecoveryConfig, CellGroupConfig, ControlResourceSet, CrossCarrierSchedulingConfig]

#### – *CSI-AperiodicTriggerStateList*

The *CSI-AperiodicTriggerStateList* IE is used to configure the UE with a list of aperiodic trigger states. Each value from 1 to 2^*reportTriggerSize* of the DCI field "CSI request" field is associated with one trigger state. Upon reception of the value associated with a trigger state, the UE will perform measurement of aperiodic CSI-RS (reference signals) and aperiodic reporting on L1 according to all entries in the *associatedReportConfigInfoList* for that trigger state.

*CSI-AperiodicTriggerStateList* information element

-- ASN1START

-- TAG-CSI-APERIODICTRIGGERSTATELIST-START

CSI-AperiodicTriggerStateList ::= SEQUENCE (SIZE (1.. maxNrOfCSI-AperiodicTriggers)) OF AperiodicTriggerState

CSI-AperiodicTriggerState ::= SEQUENCE {

associatedReportConfigInfoList SEQUENCE (SIZE(1.. maxNrofReportConfigPerAperiodicTrigger)) OF AssociatedReportConfigInfo,

...

}

AssociatedReportConfigInfo ::= SEQUENCE {

-- The reportConfigId of one of the CSI-ReportConfigToAddMod configured in CSI-MeasConfig

reportConfigId CSI-ReportConfigId,

-- NZP-CSI-RS-ResourceSet for channel measurements. Entry number in nzp-CSI-RS-ResourceSetList in the CSI-ResourceConfig indicated by

-- resourcesForChannelMeasurement in the CSI-ReportConfig indicated by reportConfigId above (1 corresponds to the first entry, 2 to the second

-- entry, and so on).

nzp-CSI-RS-ResourcesforChannel INTEGER (1..maxNrofNZP-CSI-RS-ResourceSetsPerConfig),

-- List of references to TCI-States for providing the QCL source and QCL type for for each NZP-CSI-RS-Resource listed in nzp-CSI-RS-Resources

-- of the NZP-CSI-RS-ResourceSet indicated by nzp-CSI-RS-ResourcesforChannel. First entry in qcl-info-forChannel corresponds to first entry in

-- nzp-CSI-RS-Resources of that NZP-CSI-RS-ResourceSet, second entry in qcl-info-forChannel corresponds to second entry in nzp-CSI-RS-Resources,

-- and so on. Corresponds to L1 parameter 'QCL-Info-aPeriodicReportingTrigger' (see 38.214, section 5.2.1.5.1)

qcl-info-forChannel SEQUENCE (SIZE(1..maxNrofAP-CSI-RS-ResourcesPerSet)) OF TCI-StatedId,

-- CSI-IM-ResourceSet for interference measurement. Entry number in csi-IM-ResourceSetList in the CSI-ResourceConfig indicated by

-- csi-IM-ResourcesForInterference in the CSI-ReportConfig indicated by reportConfigId above (1 corresponds to the first entry, 2 to the second

-- entry, and so on).

-- The indicated CSI-IM-ResourceSet should have exactly the same number of resources like the NZP-CSI-RS-ResourceSet indicated in

-- nzp-CSI-RS-ResourcesforChannel.

-- This field can only be present if the CSI-ReportConfig identified by reportConfigId includes csi-IM-ResourcesForInterference.

csi-IM-ResourcesforInteference INTEGER(1.. maxNrofCSI-IM-ResourceSetsPerConfig) OPTIONAL, --Cond CSI-IM-forInterference

-- NZP-CSI-RS-ResourceSet for interference measurement. Entry number in nzp-CSI-RS-ResourceSetList in the CSI-ResourceConfig indicated by

-- nzp-CSI-RS-ResourcesForInterference in the CSI-ReportConfig indicated by reportConfigId above (1 corresponds to the first entry,

-- 2 to the second entry, and so on).

-- The indicated NZP-CSI-RS-ResourceSet should have exactly the same number of resources like the NZP-CSI-RS-ResourceSet indicated in

-- nzp-CSI-RS-ResourcesforChannel.

-- This field can only be present if the CSI-ReportConfig identified by reportConfigId includes nzp-CSI-RS-ResourcesForInterference.

nzp-CSI-RS-ResourcesforInterference NZP-CSI-RS-ResourceSetId OPTIONAL, --Cond LinkedNZP-CSI-RS-forInterference

...

}

maxNrofAP-CSI-RS-ResourcesPerSet INTEGER ::= 16

maxNrOfCSI-AperiodicTriggers INTEGER ::= 128 -- Maximum number of triggers for aperiodic CSI reporting

maxNrofReportConfigPerAperiodicTrigger INTEGER ::= 16 -- Maximum number of report configurations associated to a trigger state for aperiodic CSI reporting

-- TAG-CSI-APERIODICTRIGGERSTATELIST-STOP

-- ASN1STOP

#### – *CSI-MeasConfig*

The *CSI-MeasConfig* IE is used to configure CSI-RS (reference signals) belonging to the serving cell in which *CSI-MeasConfig* is included and channel state information reports to be transmitted on L1 (PUCCH, PUSCH) on the serving cell in which *CSI-MeasConfig* is included. See also 38.214, section 5.2.

*CSI-MeasConfig* information element

-- ASN1START

-- TAG-CSI-MEAS-CONFIG-START

CSI-MeasConfig ::= SEQUENCE {

-- Pool of NZP-CSI-RS-Resource which can be referred to from NZP-CSI-RS-ResourceSet

nzp-CSI-RS-ResourceToAddModList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-Resources)) OF NZP-CSI-RS-Resource OPTIONAL, -- Need N

nzp-CSI-RS-ResourceToReleaseList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-Resources)) OF NZP-CSI-RS-ResourceId OPTIONAL, -- Need N

-- Pool of NZP-CSI-RS-ResourceSet which can be referred to from CSI-ResourceConfig or from MAC CEs

nzp-CSI-RS-ResourceSetToAddModList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourceSets)) OF NZP-CSI-RS-ResourceSet OPTIONAL, -- Need N

nzp-CSI-RS-ResourceSetToReleaseList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourceSets)) OF NZP-CSI-RS-ResourceSetId OPTIONAL, -- Need N

-- Pool of CSI-IM-Resource which can be referred to from CSI-IM-ResourceSet

csi-IM-ResourceToAddModList SEQUENCE (SIZE (1..maxNrofCSI-IM-Resources)) OF CSI-IM-Resource OPTIONAL, -- Need N

csi-IM-ResourceToReleaseList SEQUENCE (SIZE (1..maxNrofCSI-IM-Resources)) OF CSI-IM-ResourceId OPTIONAL, -- Need N

-- Pool of CSI-IM-ResourceSet which can be referred to from CSI-ResourceConfig or from MAC CEs

csi-IM-ResourceSetToAddModList SEQUENCE (SIZE (1..maxNrofCSI-IM-ResourceSets)) OF CSI-IM-ResourceSet OPTIONAL, -- Need N

csi-IM-ResourceSetToReleaseList SEQUENCE (SIZE (1..maxNrofCSI-IM-ResourceSets)) OF CSI-IM-ResourceSetId OPTIONAL, -- Need N

-- Pool of CSI-SSB-ResourceSet which can be referred to from CSI-ResourceConfig

csi-SSB-ResourceSetToAddModList SEQUENCE (SIZE (1..maxNrofCSI-SSB-ResourceSets)) OF CSI-SSB-ResourceSet OPTIONAL, -- Need N

csi-SSB-ResourceSetToAddReleaseList SEQUENCE (SIZE (1..maxNrofCSI-SSB-ResourceSets)) OF CSI-SSB-ResourceSetId OPTIONAL, -- Need N

-- Configured CSI resource settings as specified in TS 38.214 section 5.2.1.2

csi-ResourceConfigToAddModList SEQUENCE (SIZE (1..maxNrofCSI-ResourceConfigurations)) OF CSI-ResourceConfig OPTIONAL, -- Need N

csi-ResourceConfigToReleaseList SEQUENCE (SIZE (1..maxNrofCSI-ResourceConfigurations)) OF CSI-ResourceConfigId OPTIONAL, -- Need N

-- Configured CSI report settings as specified in TS 38.214 section 5.2.1.1

csi-ReportConfigToAddModList SEQUENCE (SIZE (1..maxNrofCSI-ReportConfigurations)) OF CSI-ReportConfig OPTIONAL, -- Need N

csi-ReportConfigToReleaseList SEQUENCE (SIZE (1..maxNrofCSI-ReportConfigurations)) OF CSI-ReportConfigId OPTIONAL, -- Need N

-- Size of CSI request field in DCI (bits). Corresponds to L1 parameter 'ReportTriggerSize' (see 38.214, section 5.2)

reportTriggerSize INTEGER (0..6) OPTIONAL,

-- Contains trigger states for dynamically selecting one or more aperiodic and semi-persistent reporting configurations

-- and/or triggering one or more aperiodic CSI-RS resource sets for channel and/or interference measurement.

-- FFS: How to address the MAC-CE configuration

aperiodicTriggerStateList SetupRelease { CSI-AperiodicTriggerStateList } OPTIONAL, -- Need M

semiPersistentOnPUSCH-TriggerStateList SetupRelease { CSI-SemiPersistentOnPUSCH-TriggerStateList } OPTIONAL -- Need M

},

...

}

maxNrofNZP-CSI-RS-ResourceSets INTEGER ::= 64

maxNrofNZP-CSI-RS-ResourceSets-1 INTEGER ::= 63

maxNrofCSI-SSB-ResourceSets INTEGER ::= 64

maxNrofCSI-SSB-ResourceSets-1 INTEGER ::= 63

maxNrofCSI-IM-ResourceSets INTEGER ::= 64

maxNrofCSI-IM-ResourceSets-1 INTEGER ::= 63

-- TAG-CSI-MEAS-CONFIG-STOP

-- ASN1STOP

#### – *CSI-ResourceConfig*

The IE *CSI-ResourceConfig* refers to one or more *NZP-CSI-RS-ResourceSet*, *CSI-IM-ResourceSet* and/or *CSI-SSB-ResourceSet*.

*CSI-ResourceConfig* information element

-- ASN1START

-- TAG-CSI-RESOURCECONFIG-START

-- One CSI resource configuration comprising of one or more resource sets

CSI-ResourceConfig ::= SEQUENCE {

-- Used in CSI-ReportConfig to refer to an instance of CSI-ResourceConfig

csi-ResourceConfigId CSI-ResourceConfigId,

-- Contains up to maxNrofNZP-CSI-RS-ResourceSetsPerConfig resource sets if ResourceConfigType is 'aperiodic' and 1 otherwise.

-- Corresponds to L1 parameter 'ResourceSetConfigList' (see 38.214, section 5.2.1.3.1)

csi-RS-ResourceSetList CHOICE {

nzp-CSI-RS-ResourceSetList SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourceSetsPerConfig)) OF NZP-CSI-RS-ResourceSetId,

csi-IM-ResourceSetList SEQUENCE (SIZE (1..maxNrofCSI-IM-ResourceSetsPerConfig)) OF CSI-IM-ResourceSetId

},

-- List of SSB resources used for beam measurement and reporting in a resource set

-- Corresponds to L1 parameter 'resource-config-SS-list' (see 38,214, section FFS\_Section)

csi-SSB-ResourceSetList SEQUENCE (SIZE (1..maxNrofCSI-SSB-ResourceSetsPerConfig)) OF CSI-SSB-ResourceSetId OPTIONAL, --Cond OnlyWithNZPResourceSets

-- The DL BWP which the CSI-RS associated with this CSI-ResourceConfig are located in.

-- Corresponds to L1 parameter 'BWP-Info' (see 38.214, section 5.2.1.2

bwp-Id BWP-Id,

-- Time domain behavior of resource configuration. Corresponds to L1 parameter 'ResourceConfigType' (see 38.214, section 5.2.2.3.5)

resourceType ENUMERATED { aperiodic, semiPersistent, periodic },

...

}

-- TAG-CSI-RESOURCECONFIGTOADDMOD-STOP

-- ASN1STOP

#### – *CSI-ResourceConfigId*

The IE *CSI-ResourceConfigId* is used to identify a CSI-ResourceConfig.

*CSI-ResourceConfigId* information element

-- ASN1START

-- TAG-CSI-RESOURCECONFIGID-START

CSI-ResourceConfigId ::= INTEGER (0..maxNrofCSI-ResourceConfigurations-1)

-- TAG-CSI-RESOURCECONFIGID-STOP

-- ASN1STOP

#### – *CSI-semiPersistentOnPUSCH-TriggerStateList*

The *CSI-semiPersistentOnPUSCH-TriggerStateList* IE is used to configure the UE with list of trigger states for semi-persistent reporting of channel state information on L1. . See also 38.214, section 5.2.

*CSI-semiPersistentOnPUSCH-TriggerStateList* information element

-- ASN1START

-- TAG-CSI-SEMIPERSISTENTONPUSCHTRIGGERSTATELIST-START

CSI-semiPersistentOnPUSCH-TriggerStateList ::= SEQUENCE(SIZE (1..maxNrOfSemiPersistentPUSCH-Triggers)) OF CSI-semiPersistentOnPUSCH-TriggerState

CSI-semiPersistentOnPUSCH-TriggerState ::= SEQUENCE {

associatedReportConfigInfo CSI-ReportConfigId,

...

}

maxNrOfSemiPersistentPUSCH-Triggers INTEGER ::= 64 -- Maximum number of triggers for semi persistent reporting on PUSCH

-- TAG-CSI-SEMIPERSISTENTONPUSCHTRIGGERSTATELIST-STOP

-- ASN1STOP

#### – *NZP-CSI-RS-ResourceSet*

The IE *NZP-CSI-RS-ResourceSet* is a set of Non-Zero-Power (NZP) CSI-RS resources (their IDs) and set-specific parameters.

*NZP-CSI-RS-ResourceSet* information element

-- ASN1START

-- TAG-NZP-CSI-RS-RESOURCESET-START

NZP-CSI-RS-ResourceSet ::= SEQUENCE {

nzp-CSI-ResourceSetId NZP-CSI-RS-ResourceSetId,

-- NZP-CSI-RS-Resources assocaited with this NZP-CSI-RS resource set.

-- Corresponds to L1 parameter 'CSI-RS-ResourceConfigList' (see 38.214, section 5.2)

-- For CSI, there are at most 8 NZP CSI RS resources per resource set

nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId,

-- Indicates whether repetition is on/off. If set to set to 'OFF', the UE may not assume that the

-- NZP-CSI-RS resources within the resource set are transmitted with the same downlink spatial domain transmission filter

-- and with same NrofPorts in every symbol.

-- Corresponds to L1 parameter 'CSI-RS-ResourceRep' (see 38.214, sections 5.2.2.3.1 and 5.1.6.1.2)

-- Can only be configured for CSI-RS resource sets which are associated with CSI-ReportConfig with report of L1 RSRP or “no report”

repetition ENUMERATED { on, off } OPTIONAL,

-- Offset X between the slot containing the DCI that triggers a set of aperiodic NZP CSI-RS resources and the slot in which the

-- CSI-RS resource set is transmitted. When the field is absent the UE applies the value 0.

-- Corresponds to L1 parameter 'Aperiodic-NZP-CSI-RS-TriggeringOffset' (see 38,214, section FFS\_Section)

aperiodicTriggeringOffset INTEGER(0..4) OPTIONAL, -- Need S

-- Indicates that the antenna port for all NZP-CSI-RS resources in the CSI-RS resource set is same.

-- Corresponds to L1 parameter 'TRS-Info' (see 38.214, section 5.2.2.3.1)

trs-Info ENUMERATED {true} OPTIONAL,

...

}

-- TAG-NZP-CSI-RS-RESOURCESET-STOP

-- ASN1STOP

#### – *NZP-CSI-RS-ResourceSetId*

The IE *NZP-CSI-RS-ResourceSetId* is used to identify one *NZP-CSI-RS-ResourceSet*.

*NZP-CSI-RS-ResourceSetId* information element

-- ASN1START

-- TAG-NZP-CSI-RS-RESOURCESETID-START

NZP-CSI-RS-ResourceSetId ::= INTEGER (0..maxNrofNZP-CSI-RS-ResourceSets-1)

-- TAG-NZP-CSI-RS-RESOURCESETID-STOP

-- ASN1STOP

#### – *NZP-CSI-RS-Resource*

The IE *NZP-CSI-RS-Resource* is used to configure Non-Zero-Power (NZP) CSI-RStransmitted in the cell where the IE is included, which the UE may be configured to measure on (see 38.214, section 5.2.2.3.1).

*NZP-CSI-RS-Resource* information element

-- ASN1START

-- TAG-NZP-CSI-RS-RESOURCE-START

NZP-CSI-RS-Resource ::= SEQUENCE {

nzp-CSI-RS-ResourceId NZP-CSI-RS-ResourceId,

-- Number of ports (see 38.214, section 5.2.2.3.1)

nrofPorts ENUMERATED {p1,p2,p4,p8,p12,p16,p24,p32},

-- OFDM symbol location(s) in a slot and subcarrier occupancy in a PRB of the CSI-RS resource

resourceMapping CSI-RS-ResourceMapping

,

-- Power offset of NZP CSI-RS RE to PDSCH RE. Value in dB. Corresponds to L1 parameter Pc (see 38.214, sections 5.2.2.3.1 and 4.1)

powerControlOffset INTEGER(-8..15),

-- Power offset of NZP CSI-RS RE to SS RE. Value in dB. Corresponds to L1 parameter 'Pc\_SS' (see 38.214, section 5.2.2.3.1)

powerControlOffsetSS ENUMERATED{db-3, db0, db3, db6} OPTIONAL,

-- Scrambling ID (see 38.214, section 5.2.2.3.1)

scramblingID ScramblingId,

-- Periodicity and slot offset sl1 corresponds to a periodicity of 1 slot, sl2 to a periodicity of two slots, and so on.

-- The corresponding offset is also given in number of slots. Corresponds to L1 parameter 'CSI-RS-timeConfig' (see 38.214, section 5.2.2.3.1)

periodicityAndOffset CSI-ResourcePeriodicityAndOffset OPTIONAL, --Cond PeriodicOrSemiPersistent

-- For a target periodic CSI-RS, contains a reference to one TCI-State in TCI-States for providing the QCL source and

-- QCL type. For periodic CSI-RS, the source can be SSB or another periodic-CSI-RS.

-- Corresponds to L1 parameter 'QCL-Info-PeriodicCSI-RS' (see 38.214, section 5.2.2.3.1)

qcl-InfoPeriodicCSI-RS TCI-StateId OPTIONAL, --Cond Periodic

...

}

-- TAG-NZP-CSI-RS-RESOURCE-STOP

-- ASN1STOP

#### – *CSI-FrequencyOccupation*

The IE *CSI-FrequencyOccupation* is used to configure the frequency domain occupation of a channel state information measurement resource (e.g. *NZP-CSI-RS-Resource*, *CSI-IM-Resource*).

*CSI-FrequencyOccupation* information element

-- ASN1START

-- TAG-CSI-FREQUENCYOCCUPATION-START

CSI-FrequencyOccupation ::= SEQUENCE {

-- PRB where this CSI resource starts in relation to PRB 0 of the associated BWP.

-- Only multiples of 4 are allowed (0, 4, ...)

startingRB INTEGER (0..maxNrofPhysicalResourceBlocks-1),

-- Number of PRBs across which this CSI resource spans. Only multiples of 4 are allowed. The smallest configurable

-- number is the minimum of 24 and the width of the associated BWP.

nrofRBs INTEGER (24..maxNrofPhysicalResourceBlocks)

}

-- TAG-CSI-FREQUENCYOCCUPATION-STOP

-- ASN1STOP

#### – *CSI-RS-ResourceMapping*

The IE *CSI-RS-ResourceMapping* is used to configure the resource element mapping of a CSI-RS resource in time- and frequency domain.

*CSI-RS-ResourceMapping* information element

-- ASN1START

-- TAG-CSI-RS-RESOURCEMAPPING-START

CSI-RS-ResourceMapping ::= SEQUENCE {

-- Frequency domain allocation within a physical resource block in accordance with 38.211, section 7.4.1.5.3 including table 7.4.1.5.2-1.

-- The number of bits that may be set to one depend on the chosen row in that table. For the choice "other", the row can be determined from

-- the parmeters below and from the number of bits set to 1 in frequencyDomainAllocation.

frequencyDomainAllocation CHOICE {

row1 BIT STRING (SIZE (4)),

row2 BIT STRING (SIZE (12)),

row4 BIT STRING (SIZE (3)),

other BIT STRING (SIZE (6))

},

-- Time domain allocation within a physical resource block. The field indicates the first OFDM symbol in the PRB used for CSI-RS.

-- Parameter l0 in 38.211, section 7.4.1.5.3. Value 2 is supported only when DL-DMRS-typeA-pos equals 3.

firstOFDMSymbolInTimeDomain INTEGER (0..13),

-- Time domain allocation within a physical resource block. Parameter l1 in 38.211, section 7.4.1.5.3.

firstOFDMSymbolInTimeDomain2 INTEGER (0..13) OPTIONAL, -- Need R

-- CDM type (see 38.214, section 5.2.2.3.1)

cdm-Type ENUMERATED {noCDM, fd-CDM2, cdm4-FD2-TD2, cdm8-FD2-TD4},

-- Density of CSI-RS resource measured in RE/port/PRB. Corresponds to L1 parameter 'CSI-RS-Density' (see 38.211, section 7.4.1.5.3)

-- Values 0.5 (dot5), 1 (one) and 3 (three) are allowed for X=1,

-- values 0.5 (dot5) and 1 (one) are allowed for X=2, 16, 24 and 32,

-- value 1 (one) is allowed for X=4, 8, 12.

-- For density = 1/2, includes 1 bit indication for RB level comb offset indicating whether odd or even RBs are occupied by CSI-RS

density CHOICE {

dot5 ENUMERATED {evenPRBs, oddPRBs},

one NULL,

three NULL,

spare NULL

},

-- Wideband or partial band CSI-RS. Corresponds to L1 parameter 'CSI-RS-FreqBand' (see 38.214, section 5.2.2.3.1)

freqBand CSI-FrequencyOccupation,

...

}

-- TAG-CSI-RS-RESOURCEMAPPING-STOP

-- ASN1STOP

#### – *NZP-CSI-RS-ResourceId*

The IE *NZP-CSI-RS-ResourceId* is used to identify one NZP-CSI-RS-Resource.

*NZP-CSI-RS-ResourceId* information element

-- ASN1START

-- TAG-NZP-CSI-RS-RESOURCEID-START

NZP-CSI-RS-ResourceId ::= INTEGER (0..maxNrofNZP-CSI-RS-Resources-1)

-- TAG-NZP-CSI-RS-RESOURCEID-STOP

-- ASN1STOP

#### – *CSI-IM-ResourceSet*

The IE *CSI-IM-ResourceSet* is used to configure a set of one or more CSI Interference Management (IM) resources (their IDs) and set-specific parameters.

*CSI-IM-ResourceSet* information element

-- ASN1START

-- TAG-CSI-IM-RESOURCESET-START

CSI-IM-ResourceSet ::= SEQUENCE {

csi-IM-ResourceSetId CSI-IM-ResourceSetId,

-- CSI-IM-Resources associated with this CSI-IM-ResourceSet

-- Corresponds to L1 parameter 'CSI-IM-ResourceConfigList' (see 38.214, section 5.2)

csi-IM-Resources SEQUENCE (SIZE(1..maxNrofCSI-IM-ResourcesPerSet)) OF CSI-IM-ResourceId,

...

}

-- TAG-CSI-IM-RESOURCESET-STOP

-- ASN1STOP

#### – *CSI-IM-ResourceSetId*

The IE *CSI-IM-ResourceSetId* is used to identify *CSI-IM-ResourceSet*s.

*CSI-IM-ResourceSetId* information element

-- ASN1START

-- TAG-CSI-IM-RESOURCESETID-START

CSI-IM-ResourceSetId ::= INTEGER (0..maxNrofCSI-IM-ResourceSets-1)

-- TAG-CSI-IM-RESOURCESETID-STOP

-- ASN1STOP

#### – *CSI-IM-Resource*

The IE *CSI-IM-Resource* is used to configure one CSI Interference Management (IM) resource.

*CSI-IM-Resource* information element

-- ASN1START

-- TAG-CSI-IM-RESOURCE-START

CSI-IM-Resource ::= SEQUENCE {

csi-IM-ResourceId CSI-IM-ResourceId,

-- The resource element pattern (Pattern0 (2,2) or Pattern1 (4,1)) with corresponding parameters.

-- Corresponds to L1 parameter 'CSI-IM-RE-pattern' (see 38.214, section 5.2.2.3.4)

csi-IM-ResourceElementPattern CHOICE {

pattern0 SEQUENCE {

-- OFDM subcarrier occupancy of the CSI-IM resource for Pattern0

-- Corresponds to L1 parameter 'CSI-IM-ResourceMapping' (see 38.214, section 5.2.2.3.4)

subcarrierLocation-p0 ENUMERATED { s0, s2, s4, s6, s8, s10 },

-- OFDM symbol location of the CSI-IM resource for Pattern0

-- Corresponds to L1 parameter 'CSI-IM-ResourceMapping' (see 38.214, section 5.2.2.3.4)

symbolLocation-p0 INTEGER (0..12)

},

pattern1 SEQUENCE {

-- OFDM subcarrier occupancy of the CSI-IM resource for Pattern1

-- Corresponds to L1 parameter 'CSI-IM-ResourceMapping' (see 38.214, section 5.2.2.3.4)

subcarrierLocation-p1 ENUMERATED { s0, s4, s8 },

-- OFDM symbol location of the CSI-IM resource for Pattern1

-- Corresponds to L1 parameter 'CSI-IM-ResourceMapping' (see 38.214, section 5.2.2.3.4)

symbolLocation-p1 INTEGER (0..13)

}

} OPTIONAL, --Need M

-- Frequency-occupancy of CSI-IM. Corresponds to L1 parameter 'CSI-IM-FreqBand' (see 38.214, section 5.2.2.3.2)

freqBand CSI-FrequencyOccupation OPTIONAL, -- Need M

-- Periodicity and slot offset for periodic/semi-persistent CSI-IM. Corresponds to L1 parameter 'CSI-IM-timeConfig'

periodicityAndOffset CSI-ResourcePeriodicityAndOffset OPTIONAL, --Cond PeriodicOrSemiPersistent

...

}

-- TAG-CSI-IM-RESOURCE-STOP

-- ASN1STOP

#### – *CSI-IM-ResourceId*

The IE *CSI-IM-ResourceId* is used to identify one *CSI-IM-Resource*.

*CSI-IM-ResourceId* information element

-- ASN1START

-- TAG-CSI-IM-RESOURCEID-START

CSI-IM-ResourceId ::= INTEGER (0..maxNrofCSI-IM-Resources-1)

-- TAG-CSI-IM-RESOURCEID-STOP

-- ASN1STOP

#### – *CSI-SSB-ResourceSetId*

The IE *CSI-SSB-ResourceSetId* is used to identify one SS/PBCH block resource set.

*CSI-SSB-ResourceId* information element

-- ASN1START

-- TAG-CSI-SSB-RESOURCESETID-START

CSI-SSB-ResourceSetId ::= INTEGER (0.. maxNrofCSI-SSB-ResourceSets-1)

-- TAG-CSI-SSB-RESOURCESETID-STOP

-- ASN1STOP

#### – *CSI-SSB-ResourceSet*

The IE *CSI-SSB-ResourceSet* is used to configure one SS/PBCH block resource set which refers to SS/PBCH as indicated in *ServingCellConfigCommon*.

*CSI-SSB-ResourceSet* information element

-- ASN1START

-- TAG-CSI-SSB-RESOURCESET-START

CSI-SSB-ResourceSet ::= SEQUENCE {

csi-SSB-ResourceSetId CSI-SSB-ResourceSetId,

csi-SSB-ResourceList SEQUENCE (SIZE(1..maxNrofCSI-SSB-ResourcePerSet)) OF SSB-Index,

...

}

-- TAG-CSI-SSB-RESOURCESET-STOP

-- ASN1STOP

#### – *CSI-ReportConfig*

The IE *CSI-ReportConfig* is used to configure reports sent on L1 (e.g. PUCCH) on the cell in which the *CSI-ReportConfig* is included.

*CSI-ReportConfig* information element

-- ASN1START

-- TAG-CSI-REPORTCONFIG-START

-- Configuration of a CSI-Report sent on L1 (e.g. PUCCH) (see 38.214, section 5.2.1)

CSI-ReportConfig ::= SEQUENCE {

reportConfigId CSI-ReportConfigId,

-- Indicates in which serving cell the CSI-ResourceConfigToAddMod(s) below are to be found.

-- If the field is absent, the resources are on the same serving cell as this report configuration.

carrier ServCellIndex OPTIONAL, -- Need S

-- Resources for channel measurement. csi-ResourceConfigId of a CSI-ResourceConfig included in the configuration of the serving cell

-- indicated with the field "carrier" above. This CSI-ReportConfig is associated with the DL BWP indicated by bwp-Id in that CSI-ResourceConfig.

resourcesForChannelMeasurement CSI-ResourceConfigId,

-- CSI IM resources for interference measurement. csi-ResourceConfigId of a CSI-ResourceConfig included in the configuration of the serving cell

-- indicated with the field "carrier" above. The bwp-Id in that CSI-ResourceConfigToAddMod is the same value like the bwp-Id in the

-- CSI-ResourceConfig indicated by resourcesForChannelMeasurement.

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

-- NZP CSI RS resources for interference measurement. csi-ResourceConfigId of a CSI-ResourceConfigToAddMod included in the configuration of the

-- serving cell indicated with the field "carrier" above. The bwp-Id in that CSI-ResourceConfigToAddMod is the same value like the bwp-Id in the

-- CSI-ResourceConfigToAddMod indicated by resourcesForChannelMeasurement.

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

-- Time domain behavior of reporting configuration

reportConfigType CHOICE {

periodic SEQUENCE {

-- Periodicity and slot offset. Corresponds to L1 parameter 'ReportPeriodicity'and 'ReportSlotOffset'

-- (see 38.214, section section 5.2.1.4).

reportSlotConfig CSI-ReportPeriodicityAndOffset,

-- Indicates which PUCCH resource to use for reporting on PUCCH.

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

},

semiPersistentOnPUCCH SEQUENCE {

-- Periodicity and slot offset. Corresponds to L1 parameter 'ReportPeriodicity' and 'ReportSlotOffset'

-- (see 38.214, section section 5.2.1.4).

reportSlotConfig CSI-ReportPeriodicityAndOffset,

-- Indicates which PUCCH resource to use for reporting on PUCCH.

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

},

semiPersistentOnPUSCH SEQUENCE {

-- Periodicity. Corresponds to L1 parameter 'Reportperiodicity-spCSI'. (see 38.214, section 5.2.1.1?FFS\_Section)

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

-- Timing offset Y for aperiodic reporting using PUSCH. This field lists the allowed offset values.

-- A particular value is indicated in DCI. The first report is transmitted in slot n+Y, second report in n+Y+P,

-- where P is the configured periodicity.

reportSlotOffsetList SEQUENCE (SIZE (1..4)) OF INTEGER (0..7),

-- RNTI for SP CSI-RNTI, Corresponds to L1 parameter 'SPCSI-RNTI' (see 38.214, section 5.2.1.5.2)

-- FFS: RAN1 models different RNTIs as different Search Spaces with independent configurations. Align the configuration

-- of this one (e.g. group with monitoring periodicity, PDCCH candidate configuration, DCI-Payload size...)?

csi-RNTI RNTI-Value,

-- Index of the p0-alpha set determining the power control for this CSI report transmission.

-- Corresponds to L1 parameter 'SPCSI-p0alpha' (see 38.214, section FFS\_Section)

p0alpha P0-PUSCH-AlphaSetId,

},

aperiodic SEQUENCE {

-- Timing offset Y for aperiodic reporting using PUSCH. This field lists the allowed offset values. A particular value is indicated in DCI.

-- (see 38.214, section 5.2.3)

-- FFS\_Value: Range wasn’t final in RAN1 table.

-- FFS\_FIXME: How are the DCI codepoints mapped to the allowed offsets?

reportSlotOffsetList SEQUENCE (SIZE (1..4)) OF INTEGER (0..7)

}

},

-- The CSI related quanities to report. Corresponds to L1 parameter 'ReportQuantity' (see 38.214, section REF)

reportQuantity CHOICE {

none NULL,

cri-RI-PMI-CQI NULL,

cri-RI-i1 NULL,

cri-RI-i1-CQI SEQUENCE {

-- PRB bundling size to assume for CQI calcuation when reportQuantity is CRI/RI/i1/CQI

-- Corresponds to L1 parameter 'PDSCH-bundle-size-for-CSI' (see 38.214, section 5.2.1.4)

pdsch-BundleSizeForCSI ENUMERATED {n2, n4} OPTIONAL

},

cri-RI-CQI NULL,

cri-RSRP NULL,

ssb-Index-RSRP NULL,

cri-RI-LI-PMI-CQI NULL

},

-- Reporting configuration in the frequency domain. (see 38.214, section 5.2.1.4)

reportFreqConfiguration SEQUENCE {

-- Indicates whether the UE shall report a single (wideband) or multiple (subband) CQI. (see 38.214, section 5.2.1.4)

cqi-FormatIndicator ENUMERATED { widebandCQI, subbandCQI },

-- Indicates whether the UE shall report a single (wideband) or multiple (subband) PMI. (see 38.214, section 5.2.1.4)

pmi-FormatIndicator ENUMERATED { widebandPMI, subbandPMI },

-- Indicates a contiguous or non-contigous subset of subbands in the bandwidth part which CSI shall be reported

-- for. Each bit in the bit-string represents one subband. The right-most bit in the bit string represents the

-- lowest subband in the BWP. (see 38.214, section 5.2.1.4)

-- The number of subbands is determined according to 38.214 section 5.2.1.4. It is absent if there are less than 24 PRBs (no sub band)

-- and present otherwise, the number of sub bands can be from 3 (24 PRBs, sub band size 8) to 18 (72 PRBs, sub band size 4).

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)),

...

} OPTIONAL -- Need S

},

-- Time domain measurement restriction for the channel (signal) measurements.

-- Corresponds to L1 parameter 'MeasRestrictionConfig-time-channel' (see 38.214, section 5.2.1.1)

timeRestrictionForChannelMeasurements ENUMERATED {configured, notConfigured},

-- Time domain measurement restriction for interference measurements.

-- Corresponds to L1 parameter 'MeasRestrictionConfig-time-interference' (see 38.214, section 5.2.1.1)

timeRestrictionForInterferenceMeasurements ENUMERATED {configured, notConfigured},

-- Codebook configuration for Type-1 or Type-II including codebook subset restriction

codebookConfig CodebookConfig,

-- Maximum number of CQIs per CSI report (cf. 1 for 1-CW, 2 for 2-CW)

nrofCQIsPerReport ENUMERATED {n1, n2},

-- Turning on/off group beam based reporting (see 38.214, section 5.2.1.4)

groupBasedBeamReporting CHOICE {

enabled NULL,

disabled SEQUENCE {

-- The number (N) of measured RS resources to be reported per report setting in a non-group-based report.

-- N <= N\_max, where N\_max is either 2 or 4 depending on UE capability.

-- FFS: The signaling mechanism for the gNB to select a subset of N beams for the UE to measure and report.

-- FFS: Note: this parameter may not be needed for certain resource and/or report settings

-- FFS\_ASN1: Change groupBasedBeamReporting into a CHOICE and include this field into the “no” option?

-- (see 38.214, section FFS\_Section)

-- When the field is absent the UE applies the value 1

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

}

},

-- Which CQI table to use for CQI calculation. Corresponds to L1 parameter 'CQI-table' (see 38.214, section 5.2.2.1)

cqi-Table ENUMERATED {table1, table2, spare2, spare1} OPTIONAL,

-- Indicates one out of two possible BWP-dependent values for the subband size as indicated in 38.214 table 5.2.1.4-2

-- Corresponds to L1 parameter 'SubbandSize' (see 38.214, section 5.2.1.4)

subbandSize ENUMERATED {value1, value2},

-- BLER target that the UE shall be assume in its CQI calculation.

-- Corresponds to L1 parameter 'BLER-Target' (see 38.214, section 5.2.2.1)

-- FFS\_Values (now filled with spares)

bler-Target ENUMERATED {zerodot1, spare3, space2, spare1} OPTIONAL,

-- Port indication for RI/CQI calculation. For each CSI-RS resource in the linked ResourceConfig for channel measurement,

-- a port indication for each rank R, indicating which R ports to use. Applicable only for non-PMI feedback.

-- Corresponds to L1 parameter 'Non-PMI-PortIndication' (see 38.214, section FFS\_Section)

-- The first entry in non-PMI-PortIndication corresponds to the NZP-CSI-RS-Resource indicated by the first entry in

-- nzp-CSI-RS-Resources in the NZP-CSI-RS-ResourceSet indicated in the first entry of nzp-CSI-RS-ResourceSetList of the

-- CSI-ResourceConfig whose CSI-ResourceConfigId is indicated in a CSI-MeasId together with the above CSI-ReportConfigId,

-- the second entry in non-PMI-PortIndication corresponds to the NZP-CSI-RS-Resource indicated by the second entry in

-- nzp-CSI-RS-Resources in the NZP-CSI-RS-ResourceSet indicated in the first entry of nzp-CSI-RS-ResourceSetList of the

-- same CSI-ResourceConfig, and so on until the NZP-CSI-RS-Resource indicated by the last entry in nzp-CSI-RS-Resources

-- in the in the NZP-CSI-RS-ResourceSet indicated in the first entry of nzp-CSI-RS-ResourceSetList of the

-- same CSI-ResourceConfig, then the next entry corresponds to the NZP-CSI-RS-Resource indicated by the first entry

-- in nzp-CSI-RS-Resources in the NZP-CSI-RS-ResourceSet indicated in the second entry of nzp-CSI-RS-ResourceSetList of the

-- same CSI-ResourceConfig and so on.

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

}

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 ::= CHOICE {

uplinkBandwidthPartId BWP-Id,

-- PUCCH resource for the associated uplink BWP. Only PUCCH-Resource of format 2, 3 and 4 is supported.

pucch-Resource PUCCH-Resource

}

-- The PortIndexFor8Ranks allows to indicate port indexes for 1 to 8 ranks using a port index ranges from 0 to 31, or from 0 to 15, or from 0

-- to 7, or from 0 to 3, or from 0 to 1, or with 0 only.

PortIndexFor8Ranks ::= CHOICE {

portIndex8 SEQUENCE{

rank1-8 PortIndex8,

rank2-8 SEQUENCE(SIZE(1..2)) OF PortIndex8,

rank3-8 SEQUENCE(SIZE(1..3)) OF PortIndex8,

rank4-8 SEQUENCE(SIZE(1..4)) OF PortIndex8,

rank5-8 SEQUENCE(SIZE(1..5)) OF PortIndex8,

rank6-8 SEQUENCE(SIZE(1..6)) OF PortIndex8,

rank7-8 SEQUENCE(SIZE(1..7)) OF PortIndex8,

rank8-8 SEQUENCE(SIZE(1..8)) OF PortIndex8

},

portIndex4 SEQUENCE{

rank1-4 PortIndex4,

rank2-4 SEQUENCE(SIZE(1..2)) OF PortIndex4,

rank3-4 SEQUENCE(SIZE(1..3)) OF PortIndex4,

rank4-4 SEQUENCE(SIZE(1..4)) OF PortIndex4

},

portIndex2 SEQUENCE{

rank1-2 PortIndex2,

rank2-2 SEQUENCE(SIZE(1..2)) OF PortIndex2

},

portIndex1 NULL

}

PortIndex32::= INTEGER (0..31)

PortIndex16::= INTEGER (0..15)

PortIndex8::= INTEGER (0..7)

PortIndex4::= INTEGER (0..3)

PortIndex2::= INTEGER (0..1)

maxNrofNZP-CSI-RS-ResourcesPerConfig ::== 128

-- TAG-CSI-REPORTCONFIG-STOP

-- ASN1STOP

#### – *CSI-ReportConfigId*

The IE *CSI-ReportConfigId* is used to identify one *CSI-ReportConfig*.

*CSI-ReportConfigId* information element

-- ASN1START

-- TAG-CSI-REPORTCONFIGID-START

CSI-ReportConfigId ::= INTEGER (0..maxNrofCSI-ReportConfigurations-1)

-- TAG-CSI-REPORTCONFIGID-STOP

-- ASN1STOP

#### – *CSI-ResourcePeriodicityAndOffset*

The IE *CSI-ResourcePeriodicityAndOffset* is used to configure a periodicity and a corresponding offset for periodic and semi-persistent CSI resources, and for periodic and semi-persistent reporting on PUCCH. both, the periodicity and the offset are given in number of slots. The periodicity value slots4 corresponds to 4 slots, slots5 corresponds to 5 slots, and so on.

*CSI-ResourcePeriodicityAndOffset* information element

-- ASN1START

-- TAG-CSI-RESOURCEPERIODICITYANDOFFSET-START

CSI-ResourcePeriodicityAndOffset ::= 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),

slots32 INTEGER (0..31),

slots40 INTEGER (0..39),

slots64 INTEGER (0..63),

slots80 INTEGER (0..79),

slots160 INTEGER (0..159),

slots320 INTEGER (0..319),

slots640 INTEGER (0..639)

}

-- TAG-CSI-RESIYRCEPERIODICITYANDOFFSET-STOP

-- ASN1STOP

#### – *CodebookConfig*

The IE *CodebookConfig* is used to configure codebooks of Type-I and Type-II (see 38.214, section 5.2.2.2)

*CodebookConfig* information element

-- ASN1START

-- TAG-CODEBOOKCONFIG-START

CodebookConfig ::= SEQUENCE {

-- CodebookType including possibly sub-types and the corresponding parameters for each. Corresponds to L1 parameter 'CodebookType'

-- (see 38.214, section 5.2.2.2)

codebookType CHOICE {

type1 SEQUENCE {

subType CHOICE {

typeI-SinglePanel SEQUENCE {

nrOfAntennaPorts CHOICE {

two SEQUENCE {

-- Codebook subset restriction for 2TX codebook

-- Corresponds to L1 parameter ' TypeI-SinglePanel-2Tx-CodebookSubsetRestriction' (see 38.214 section 5.2.2.2.1)

twoTX-CodebookSubsetRestriction BIT STRING (SIZE (6))

},

moreThanTwo SEQUENCE {

-- Number of antenna ports in first (n1) and second (n2) dimension and codebook subset restriction

-- Corresponds to L1 parameters 'CodebookConfig-N1', 'CodebookConfig-N2'

-- 'TypeI-SinglePanel-CodebookSubsetRestriction ' (see 38.214 section 5.2.2.2.1)

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))

},

-- i2 codebook subset restriction for Type I Single-panel codebook used when reportQuantity is CRI/Ri/i1/CQI

-- Corresponds to L1 parameter 'TypeI-SinglePanel-CodebookSubsetRestriction-i2' (see 38.214 section 5.2.2.2.1)

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

}

},

-- Restriction for RI for TypeI-SinglePanel-RI-Restriction

-- Corresponds to L1 parameter 'TypeI-SinglePanel-RI-Restriction' (see 38.214, section 5.2.2.2.1)

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

},

typeI-MultiPanel SEQUENCE {

-- Codebook subset restriction for Type I Multi-panel codebook

-- Corresponds to L1 parameter 'TypeI-MultiPanel-CodebookSubsetRestriction' (see 38.214, section 5.2.2.2.2)

ng-n1-n2 CHOICE {

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

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

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

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

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

four-four-one-TypeI-MultiPanel-Restriction BIT STRING (SIZE (64)),

two-four-two-TypeI-MultiPanel-Restriction BIT STRING (SIZE (256)),

four-two-two-TypeI-MultiPanel-Restriction BIT STRING (SIZE (256))

},

-- Restriction for RI for TypeI-MultiPanel-RI-Restriction

-- Corresponds to L1 parameter 'TypeI-MultiPanel-RI-Restriction' (see 38.214, section 5.2.2.2.2)

ri-Restriction BIT STRING (SIZE (4))

}

},

-- CodebookMode as specified in 38.214 section 5.2.2.2.2

codebookMode INTEGER (1..2)

},

type2 SEQUENCE {

subType CHOICE {

typeII SEQUENCE {

-- Number of antenna ports in first (n1) and second (n2) dimension and codebook subset restriction

-- Corresponds to L1 parameters 'CodebookConfig-N1', 'CodebookConfig-N2'

-- The CHOICE name indicates the value of n1 and n2, the CHOICE contents is the codebook subset restriction bitmap

-- Corresponds to L1 parameter ' TypeII-CodebookSubsetRestriction' (see 38.214 section 5.2.2.2.3)

-- Number of bits for codebook subset restriction is ceil(log2(nchoosek(O1\*O2,4)))+8\*n1\*n2 where nchoosek(a,b) = a!/(b!(a-b)!)

n1-n2-codebookSubsetRestriction CHOICE {

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

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

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

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

six-one BIT STRING (SIZE (49)),

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

eight-one BIT STRING (SIZE (65)),

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

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

twelve-one BIT STRING (SIZE (129)),

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

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

sixteen-one BIT STRING (SIZE (129))

},

-- Restriction for RI for TypeII-RI-Restriction

-- Corresponds to L1 parameter 'TypeII-RI-Restriction' (see 38.214, section 5.2.2.2.3)

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

},

typeII-PortSelection SEQUENCE {

-- Restriction for RI for TypeII-PortSelection-RI-Restriction

-- Corresponds to L1 parameter 'TypeII-PortSelection-RI-Restriction' (see 38.214, section 5.2.2.4)

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

}

},

-- The size of the PSK alphabet, QPSK or 8-PSK

phaseAlphabetSize ENUMERATED {n4, n8},

-- If subband amplitude reporting is activated (true)

subbandAmplitude BOOLEAN,

-- Number of beams, L, used for linear combination

numberOfBeams ENUMERATED {two, three, four}

}

}

}

-- TAG-CODEBOOKCONFIG-STOP

-- ASN1STOP

[DMRS-DownlinkConfig, DMRS-UplinkConfig, DRB-Identity, MeasResultSCG-Failure, FrequencyInfoDL, SCS-SpecificVirtualCarrier, FrequencyInfoUL, GSCN-ValueNR, LogicalChannelConfig, MAC-CellGroupConfig, MeasConfig, MeasGapConfig, MeasId, MeasIdToAddModList, MeasObjectEUTRA, MeasObjectId, MeasObjectNR, MeasObjectToAddModList, MeasResults, PDCCH-ConfigCommon, PDCCH-Config, PDCP-Config, PDSCH-Config, PCI-List, PCI-Range, PCI-RangeIndex, PCI-RangeIndexList, PhysCellId, PRB-Id, PTRS-DownlinkConfig, PTRS-UplinkConfig, PUCCH-Config, PUSCH-Config, PUSCH-PowerControl, Q-OffsetRange, QuantityConfig, RACH-ConfigCommon, RACH-ConfigCommonGeneric, RACH-ConfigDedicated, RadioBearerConfig, ReportConfigId, ReportConfigNR, ReportConfigToAddModList, ReportInterval, RLC-Config, RLF-TimersAndConstants, RNTI-Value, RSRP-Range, RSRQ-Range, SINR-Range, SCellIndex, SchedulingRequest-Config, SchedulingRequestResourceConfig, SchedulingRequestResourceId, ScramblingId, SDAP-Config, SearchSpace, SlotFormatIndicatorSFI, DownlinkPreemption, SearchSpaceId, SecurityAlgorithmConfig, ServCellIndex, ServingCellConfigCommon, ServingCellConfig, SlotFormatCombinationsPerCell, SRB-Identity, SPS-Config, ConfiguredGrantConfig, SRS-Config, SRS-CarrierSwitching, SSB-Index, SubcarrierSpacing]

#### – *TCI-State*

The *TCI-State* IE associates one or two DL reference signals with a corresponding quasi-colocation (QCL) type.

*TCI-State* information element

-- ASN1START

-- TAG-TCI-STATE-START

TCI-State ::= SEQUENCE {

tci-StateId TCI-StateId,

qcl-Type1 QCL-Info,

qcl-Type2 QCL-Info OPTIONAL, -- Need R

nrofPTRS-Ports ENUMERATED {n1, n2} OPTIONAL, -- Need R

...

}

TCI-StateId ::= INTEGER (0.. maxNrofTCI-States-1)

QCL-Info ::= SEQUENCE {

-- The carrier which the RS is located in. If the field is absent, it applies to the serving cell in which the TCI-State is configured

cell ServCellIndex OPTIONAL, -- Need R

-- The DL BWP which the RS is located in.

bwp-Id BWP-Id OPTIONAL, -- Cond CSI-RS-Indicated

-- Cond NZP-CSI-RS-Indicated: mandatory if csi-rs or csi-RS-for-tracking is included, absent otherwise

referenceSignal CHOICE {

csi-rs NZP-CSI-RS-ResourceId,

ssb SSB-Index,

-- A set of CSI-RS resources for tracking

csi-RS-for-tracking NZP-CSI-RS-ResourceSetId

},

qcl-Type ENUMERATED {typeA, typeB, typeC, typeD},

...

}

-- TAG-TCI-STATE-STOP

-- ASN1STOP

[TDD-UL-DL-Config]

#### – *ZP-CSI-RS-Resource*

The IE *ZP-CSI-RS-Resource* is used to configure a Zero-Power (ZP) CSI-RS resource. Corresponds to L1 parameter 'ZP-CSI-RS-ResourceConfig' (see 38.214, section 5.1.4.2).

*ZP-CSI-RS-Resource* information element

-- ASN1START

-- TAG-ZP-CSI-RS-RESOURCE-START

ZP-CSI-RS-Resource ::= SEQUENCE {

-- ZP CSI-RS resource configuration ID

-- Corresponds to L1 parameter 'ZP-CSI-RS-ResourceConfigId' (see 38.214, section 5.1.4.2)

zp-CSI-RS-ResourceId ZP-CSI-RS-ResourceId,

-- OFDM symbol and subcarrier occupancy of the ZP-CSI-RS resource within a slot

resourceMapping CSI-RS-ResourceMapping,

-- Periodicity and slot offset for periodic/semi-persistent ZP-CSI-RS

-- Corresponds to L1 parameter 'ZP-CSI-RS-timeConfig' (see 38.214, section 5.1.4.2)

periodicityAndOffset CSI-ResourcePeriodicityAndOffset OPTIONAL, --Cond PeriodicOrSemiPersistent

...

}

ZP-CSI-RS-ResourceId ::= INTEGER (0..maxNrofZP-CSI-RS-Resources-1)

-- TAG-ZP-CSI-RS-RESOURCE-STOP

-- ASN1STOP

#### – *ZP-CSI-RS-ResourceSet*

The IE *ZP-CSI-RS-ResourceSet* refers to a set of *ZP-CSI-RS-Resources* using their *ZP-CSI-RS-ResourceId*s. It corresponds to the L1 parameter '*ZP-CSI-RS-ResourceSetConfigList*'.

*ZP-CSI-RS-ResourceSet* information element

-- ASN1START

-- TAG-ZP-CSI-RS-RESOURCESET-START

ZP-CSI-RS-ResourceSet ::= SEQUENCE {

zp-CSI-RS-ResourceSetId ZP-CSI-RS-ResourceSetId,

-- The list of ZP-CSI-RS-ResourceId identifying the ZP-CSI-RS-Resource elements belonging to this set.

zp-CSI-RS-ResourceIdList SEQUENCE (SIZE(1..maxNrofZP-CSI-RS-ResourcesPerSet)) OF ZP-CSI-RS-ResourceId,

-- Time domain behavior of ZP-CSI-RS resource configuration.

-- Corresponds to L1 parameter 'ZP-CSI-RS-ResourceConfigType' (see 38.214, section 5.1.4.2)

resourceType ENUMERATED {aperiodic, semiPersistent, periodic},

...

}

-- TAG-ZP-CSI-RS-RESOURCESET-STOP

-- ASN1STOP

#### – *ZP-CSI-RS-ResourceSetId*

The IE *ZP-CSI-RS-ResourceSetId* identifies a *ZP-CSI-RS-ResourceSet*.

*ZP-CSI-RS-ResourceSetId* information element

-- ASN1START

-- TAG-ZP-CSI-RS-RESOURCESETID-START

ZP-CSI-RS-ResourceSetId ::= INTEGER (0..maxNrofZP-CSI-RS-ResourceSets-1)

-- TAG-ZP-CSI-RS-RESOURCESETID-STOP

-- ASN1STOP

[UE capability information elements]

## 6.4 RRC multiplicity and type constraint values

### – Multiplicity and type constraint definitions

-- ASN1START

-- TAG-MULTIPLICITY-AND-TYPE-CONSTRAINT-DEFINITIONS-START

maxNrofCSI-ReportConfigurations INTEGER ::= 256 -- Maximum number of CSI report configurations

maxNrofCSI-ReportConfigurations-1 INTEGER ::= 255 -- Maximum number of CSI report configurations minus 1

maxNrofCSI-ResourceConfigurations INTEGER ::= 128 -- Maximum number of resource configurations

maxNrofCSI-ResourceConfigurations-1 INTEGER ::= 127 -- Maximum number of resource configurations minus 1

maxNrofNZP-CSI-RS-ResourceSetsPerConfig INTEGER ::= 16 -- Maximum number of NZP CSI RS resource sets per resource configuration

maxNrofCSI-IM-ResourceSetsPerConfig INTEGER ::= 16 -- Maximum number of CSI IM resource sets per resource configuration

maxNrofCSI-SSB-ResourceSetsPerConfig INTEGER ::= 1 -- Maximum number of CSI SSB resource sets per resource configuration

maxNrofNZP-CSI-RS-Resources INTEGER ::= 256 -- Maximum number of Non-Zero-Power (NZP) CSI-RS resources

maxNrofNZP-CSI-RS-Resources-1 INTEGER ::= 255 -- Maximum number of Non-Zero-Power (NZP) CSI-RS resources minus 1

maxNrofZP-CSI-RS-Resources INTEGER ::= 3 -- Maximum number of Zero-Power (NZP) CSI-RS resources

maxNrofZP-CSI-RS-Resources-1 INTEGER ::= 2 -- Maximum number of Zero-Power (NZP) CSI-RS resources minus 1

maxNrofCSI-IM-Resources INTEGER ::= 256 -- Maximum number of CSI-IM resources. See CSI-IM-ResourceMax in 38.214.

maxNrofCSI-IM-Resources-1 INTEGER ::= 255 -- Maximum number of CSI-IM resources minus 1. See CSI-IM-ResourceMax in 38.214.

maxNrofCSI-IM-ResourcesPerSet INTEGER ::= 64 -- Maximum number of CSI-IM resources per set. See CSI-IM-ResourcePerSetMax in 38.214

maxNrofSSB-Resources-1 INTEGER ::= 63 -- Maximum number of SSB resources in a resource set minus 1

maxNrofNZP-CSI-RS-ResourcesPerSet INTEGER ::= 64 -- Maximum number of NZP CSI-RS resources per resource set

maxNrofCSI-SSB-ResourcePerSet INTEGER ::= 64 -- Maximum number of SSB-

maxNrofTCI-States INTEGER ::= 64

maxNrofTCI-States-1 INTEGER ::= 63

maxNrofZP-CSI-RS-ResourceSets-1 INTEGER ::= 16

maxNrofZP-CSI-RS-ResourcesPerSet INTEGER ::= 16

-- TAG-MULTIPLICITY-AND-TYPE-CONSTRAINT-DEFINITIONS-STOP

-- ASN1STOP