**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-MeasConfig*

The *CSI-MeasConfig* IE is used to configure the UE for measuring CSI-RS (reference signals) and for reporting those measurements on L1 (PUCCH, PUSCH) as channel state information. See also 38.214, section 5.2.

*CSI-MeasConfig* information element

-- ASN1START

-- TAG-CSI-MEAS-CONFIG-START

CSI-MeasConfig ::= SEQUENCE {

csi-ResourceConfigs SEQUENCE (SIZE (1..maxNrofCSI-ResrouceConfigurations)) OF CSI-ResourceConfig OPTIONAL,

csi-ReportConfigs SEQUENCE (SIZE (1..maxNrofCSI-Reports)) OF CSI-ReportConfig OPTIONAL,

csi-MeasIdToAddModList SEQUENCE (SIZE (1..maxNrofCSI-MeasId)) OF CSI-MeasIdToAddMod OPTIONAL,

csi-MeasIdToReleaseList SEQUENCE (SIZE (1..maxNrofCSI-MeasID)) OF CSI-MeasId OPTIONAL

-- 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.

-- New description (still not clear and not fitting to other fields): Each trigger state is associated with one or multiple ReportConfigs where each ReportConfig is linked to one or two or three P/SP/AP CSI-RS resource setting(s). If a resource setting linked to a ReportConfig has multiple aperiodic resource sets and only a subset of the aperiodic resource sets is associated with the trigger state, a bitmap (with the bitwidth Nbit =number of resource sets in a resource setting. Number of one(s) in the bitmap None = 1 (FFS on 2) for CSI acquisition) is RRC configured per trigger state per resource setting to select CSI-IM/NZP CSI-RS resource set(s) from the resource setting.

-- FFS\_CHECK: Is this the appropriate place for the IE or should it be inside the resource configuration or in a set?

-- FFS\_FIXME: This is just one report trigger. But of course it should be a list. Maximum number of configured triggers depends

-- on the trigger size

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

reportTrigger SEQUENCE {

aperiodic SEQUENCE {

-- The CSI-ReportConfig (their IDs) associated with this reportTrigger

associatedReportConfigs SEQUENCE (SIZE (1..maxNrofReportConfigIdsPerTrigger)) OF CSI-ReportConfigId,

-- bitmap with the bitwidth Nbit =number of resource sets (max number Nbit = 64) in a linked resource setting per report trigger tate.

-- Number of one(s) in the bitmap None = 1 for CSI acquisition (FFS 1<= None <= 64 for beam management).

-- FFS: To enforce the number of linked resources, the linking information should instead be in the report that uses the resource

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

-- FFS\_FIXME: The following list assumes that all NZP- and IM resource sets use a common ID space. But that is not ensured

-- due to having separate lists of sets.

associatedResourceSets SEQUENCE (SIZE (1..64)) OF NZP-CSI-ResourceSetId OPTIONAL,

-- For a trigger state within aperiodicReportTrigger that triggers a ap-CSI-RS resource set, contains a list of

-- references to TCI-State elements configured in PDSCH-Config for providing the QCL source and QCL type for each ap-CSI-RS

-- resource within the triggered set of ap-CSI-RS resources. The length of the list is equal to the number of

-- aperiodic CSI-RS resources in the set (CSI-RS-ResourceSet). For a target aperiodic CSI-RS assoicated with each

-- triggering state, contains a reference to one TCI-RS-Set in TCI-States for providing the QCL source and QCL type.

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

qcl-Info-aPeriodicReportingTrigger SEQUENCE (SIZE(1..ffsValue)) OF TCI-StateId OPTIONAL

},

semiPersistentOnPUSCH SEQUENCE {

associatedReportConfig CSI-ReportConfigId

}

}

}

-- TAG-CSI-MEAS-CONFIG-STOP

-- ASN1STOP

#### – *CSI-ResourceConfig*

The IE *CSI-ResourceConfig* comprises of one or more NZP-CSI-RS-ResourceSets, CSI-IM-ResourceSet and/or CSI-SSB-Resource

*CSI-ResourceConfig* information element

-- ASN1START

-- TAG-CSI-RESOURCECONFIG-START

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

CSI-ResourceConfig ::= SEQUENCE {

csi-ResourceConfigId CSI-ResourceConfigId,

-- Contains up to maxNrofCSI-ResourceSets resource CSI-ReosurceSets if ResourceConfigType is 'aperiodic' and 1 otherwise.

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

csi-RS-ResourceSets CHOICE {

nzp-CSI-RS-ResourceSets SEQUENCE (SIZE (1..maxNrofCSI-ResourceSets)) OF NZP-CSI-RS-ResourceSet,

csi-IM-ResourceSets SEQUENCE (SIZE (1..maxNrofCSI-ResourceSets)) OF CSI-IM-ResourceSet

},

-- 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)

ssb-Resources SEQUENCE (SIZE (1..maxNrofSSB-Resources)) OF CSI-SSB-Resource OPTIONAL, --Cond OnlyWithNZPResourceSets

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

-- Corresponds to L1 parameter 'BWP-Info' (see 38.214, section FFS\_Section)

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 CHOICE {

aperiodic NULL,

semiPersistent NULL,

periodic SEQUENCE {

-- 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 FFS\_Section)

qcl-InfoPeriodicCSI-RS TCI-StateId OPTIONAL

}

},

-- Indication of which Serving Cell the configured CSI-RS is located in.

-- FFS\_CHECK: RAN1 intended to enable cross-carrier scheduling of aperiodoic CSI-RS. This field would indicate on which ServingCell

-- the UE finds these resources. Discuss whether and how this works considering that currently a CSI-MeasConfig exists per ServingCell

-- Corresponds to L1 parameter 'CC\_Info' (see 38.214, section 5.2.2.3.1)

crossCarrierInfo FFS\_Value OPTIONAL,

...

}

-- TAG-CSI-RESOURCECONFIG-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

#### – *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-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)

-- FFS: Better make the csi-rs-Resources a common pool on CSI-MeasConfig level?

nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofCSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-Resource,

-- 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)

repetition ENUMERATED { on, off },

-- 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)

-- FFS\_CHECK: Is this field at the correct place? Or should it be in the trigger configuration instead?

aperiodicTriggeringOffset FFS\_Value OPTIONAL -- Need S

}

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

-- ASN1STOP

#### – *NZP-CSI-ResourceSetId*

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

*NZP-CSI-ResourceSetId* information element

-- ASN1START

-- TAG-NZP-CSI-RESOURCESETID-START

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

-- TAG-NZP-CSI-RESOURCESETID-STOP

-- ASN1STOP

#### – *NZP-CSI-RS-Resource*

The IE *NZP-CSI-RS-Resource* is used to configure Non-Zero-Power (NZP) CSI-RS-Resource, 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,

-- 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.

frequencyDomainAllocation CHOICE {

row1 BIT STRING (SIZE (4)),

row2 BIT STRING (SIZE (12)),

row3 BIT STRING (SIZE (6)),

row4 BIT STRING (SIZE (3)),

row5 BIT STRING (SIZE (6)),

row7 BIT STRING (SIZE (6)),

row8 BIT STRING (SIZE (6)),

row9 BIT STRING (SIZE (6)),

row10 BIT STRING (SIZE (6)),

row11 BIT STRING (SIZE (6)),

row12 BIT STRING (SIZE (6)),

row13 BIT STRING (SIZE (6)),

row14 BIT STRING (SIZE (6)),

row15 BIT STRING (SIZE (6)),

row16 BIT STRING (SIZE (6)),

row17 BIT STRING (SIZE (6)),

row18 BIT STRING (SIZE (6)),

row19 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,

-- 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 FFS\_Section)

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,

-- Indicates whether or not the antenna ports of 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-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

#### – *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 {

-- FFS: Where is the csi-im-ResourceSetId used?

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-Resource

}

-- 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..maxNrof CSI-IM-ResourceSets)

-- 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

}

-- 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-Resource*

The IE *CSI-SSB-Resource* is used to configure one SSB resource.

*CSI-SSB-Resource* information element

-- ASN1START

-- TAG-CSI-SSB-RESOURCE-START

CSI-SSB-Resource ::= SEQUENCE {

-- FFS: Undefined what the IE CSI-SSB-Resource contains.

}

-- TAG-CSI-SSB-RESOURCE-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. both, the periodicity and the offset are given in number of slots. The periodicity value sl4 corresponds to 4 slots, sl5 corresponds to 5 slots, and so on.

*CSI-ResourcePeriodicityAndOffset* information element

-- ASN1START

-- TAG-CSI-RESOURCEPERIODICITYANDOFFSET-START

CSI-ResourcePeriodicityAndOffset ::= CHOICE {

sl4 INTEGER (0..3),

sl5 INTEGER (0..4),

sl8 INTEGER (0..7),

sl10 INTEGER (0..9),

sl16 INTEGER (0..15),

sl20 INTEGER (0..19),

sl32 INTEGER (0..31),

sl40 INTEGER (0..39),

sl64 INTEGER (0..63),

sl80 INTEGER (0..79),

sl160 INTEGER (0..159),

sl320 INTEGER (0..319),

sl640 INTEGER (0..639)

}

-- TAG-CSI-RESOURCEPERIODICITYANDOFFSET-STOP

-- ASN1STOP

#### – *CSI-ReportConfig*

The IE *CSI-ReportConfig* is used to configure FFS

*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,

-- 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 CHOICE {

sl4 INTEGER(0..3),

sl5 INTEGER(0..4),

sl8 INTEGER(0..7),

sl10 INTEGER(0..9),

sl16 INTEGER(0..15),

sl20 INTEGER(0..19),

sl40 INTEGER(0..39),

sl80 INTEGER(0..79),

sl160 INTEGER(0..159),

sl320 INTEGER(0..319)

},

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

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

},

semiPersistentPUCCH SEQUENCE {

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

-- (see 38.214, section section 5.2.1.4).

reportSlotConfig CHOICE {

sl4 INTEGER(0..3),

sl5 INTEGER(0..4),

sl8 INTEGER(0..7),

sl10 INTEGER(0..9),

sl16 INTEGER(0..15),

sl20 INTEGER(0..19),

sl40 INTEGER(0..39),

sl80 INTEGER(0..79),

sl160 INTEGER(0..159),

sl320 INTEGER(0..319)

},

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

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

},

semiPersistentPUSCH 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},

-- 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?

reportSlotOffset SEQUENCE (SIZE (1..4)) OF INTEGER (0..8)

}

},

-- 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. FFS: 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)

-- FFS: Size of the bitmap. Introduce a CHOICE with different bitmap lengths depening on number of subbands in carrier/BWP?

csi-ReportingBand BIT STRING (SIZE (ffsValue))

},

-- 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 SEQUENCE {

-- Number of beams to report for group based beam reporting (see 38.214, section REF)

nrofBeamsToReport ENUMERATED {ffsTypeAndValue}

},

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)

non-PMI-PortIndication FFS\_Value OPTIONAL,

-- Which DL BWP the CSI-ReportConfig is associated with. (see 38.214, section FFS\_Section)

-- FFS\_CHECK: Should it be possible to link a report to several BWPs? If not, shouldn’t the report configuration be in the BWP?

-- FFS\_CHECK: Should it be possible to link a report to the initial BWP? If so, which ID does that have?

bwp-Id BWP-Id, OPTIONAL

}

PUCCH-CSI-Resource ::= CHOICE {

uplinkBandwidthPartId BWP-Id,

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

pucch-Resource PUCCH-Resource

}

-- 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-ReportConfig-1)

-- TAG-CSI-REPORTCONFIGID-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 {

-- Number of antenna ports in first dimension

codebookConfigN1 ENUMERATED {n1,n2,n3,n4,n6,n8,n12,n16},

-- Number of antenna ports in second dimension

codebookConfigN2 ENUMERATED {n1,n2,n3,n4},

-- Codebook subset restriction for the different codebooks

-- 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 ENUMERATED {typeI-SinglePanel, typeI-MultiPanel},

-- Switch between Config 1 and Config 2

codebookMode ENUMERATED {config1, config2},

-- Number of panels, Ng, used in multi-panel codebook

numberOfPanels ENUMERATED {twopanels, fourpanels} OPTIONAL, -- Cond TypeI-MultiPanel

codebookSubsetRestrictionType1 CHOICE {

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

-- Corresponds to L1 parameter 'TypeI-SinglePanel-CodebookSubsetRestriction' (see 38.214, section FFS\_Section)

-- FFS\_Value: RAN1 indicated Bitmap of size N1\*N2\*O1\*O2

singlePanel BIT STRING (SIZE (ffsValue)),

-- Codebook subset restriction for 2TX codebook

-- Corresponds to L1 parameter 'TypeI-SinglePanel-2Tx-CodebookSubsetRestriction' (see 38.214, section FFS\_Section)

singlePanel2TX BIT STRING (SIZE (6)),

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

-- Corresponds to L1 parameter 'TypeI-MultiPanel-CodebookSubsetRestriction' (see 38.214, section FFS\_Section)

multiPanel BIT STRING (SIZE (ffsValue)),

-- 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 FFS\_Section)

singlePanelCodebookSubsetRestriction-i2 BIT STRING (SIZE (16))

},

ri-Restriction CHOICE {

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

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

typeI-SinglePanelRI-Restriction BIT STRING (SIZE (8)),

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

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

typeI-MultiPanelRI-Restriction BIT STRING (SIZE (4))

}

},

type2 SEQUENCE {

subType ENUMERATED {typeII, typeII-PortSelection},

-- 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},

-- The size of the port selection codebook (parameter d)

portSelectionSamplingSize ENUMERATED {n1, n2, n3, n4} OPTIONAL, -- Cond TypeII-PortSelection

-- Codebook subset restriction for Type II codebook.

-- FFS: Clarify the meaning of the bitmap

-- FFS: The size of the bitmap is ceil(log2(nchoosek(O1\*O2,4)))+8\*N1\*N2 ==> Clarify size. Present different bitmap sizes by CHOICE?

codebookSubsetRestrictionType2 BIT STRING (SIZE (ffsValue)),

ri-Restriction CHOICE {

-- Restriction for RI for TypeII-RI-Restriction

-- Corresponds to L1 parameter 'TypeII-RI-Restriction' (see 38.214, section 5.2.2.3)

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

-- 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))

}

}

}

}

-- TAG-CODEBOOKCONFIG-STOP

-- ASN1STOP

#### – *CSI-MeasIdToAddMod*

The IE *CSI-MeasIdToAddMod* is used to link a *CSI-RS-ResourceConfig* to a *CSI-ReportConfig* (see 38.214, section 5.2)

*CSI-MeasIdToAddMod* information element

-- ASN1START

-- TAG-CSI-MEASIDTOADDMOD-START

CSI-MeasIdToAddMod ::= SEQUENCE {

csi-measId CSI-MeasId,

csi-RS-resourceConfigId CSI-ResourceConfigId,

csi-ReportConfigId CSI-ReportConfigId,

-- For CQI-Emulation, i.e., how to measure and compute the CQI.

-- CHECK: Clarify further what the values mean.

-- CHECK: Is there a need to inform the UE which resource to use for which measurement (signal, interference, ...)?

measQuantity ENUMERATED {channel, interference}

}

-- TAG-CSI-MEASIDTOADDMOD-STOP

-- ASN1STOP

#### – *CSI-MeasId*

The IE *CSI-MeasId* is used to identify one *CSI-MeasIdToAddMod* entry

*CSI-MeasId* information element

-- ASN1START

-- TAG-CSI-MEASID-START

CSI-MeasId ::= INTEGER (0..maxNrofCSI-MeasId-1)

-- TAG-CSI-MEASID-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

}

TCI-StateId ::= INTEGER (0..ffsValue)

QCL-Info ::= SEQUENCE {

referenceSignal CHOICE {

csi-rs NZP-CSI-RS-ResourceConfigId,

ssb SSB-Id,

-- A TRS (Tracking Reference Signal) configuration represented as a set of CSI-RS-Resources in a NZP-CSI-ResourceSetId

trs NZP-CSI-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 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 FFS\_Section)

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

-- Frequency domain allocation within a physical resource block in accordance with 38.211, table 7.4.1.5.2-1. FFS: Table correct?

-- The number of bits that may be set to one depend on the chosen row in that table.

-- Corresponds to L1 parameter 'ZP-CSI-RS-ResourceMapping' (see 38.214, section FFS\_Section)

frequencyDomainAllocation CHOICE {

row1 BIT STRING (SIZE (4)),

row2 BIT STRING (SIZE (12)),

row4 BIT STRING (SIZE (3)),

row5 BIT STRING (SIZE (6)),

row6 BIT STRING (SIZE (6)),

row7 BIT STRING (SIZE (6)),

row8 BIT STRING (SIZE (6)),

row9 BIT STRING (SIZE (6)),

row10 BIT STRING (SIZE (6)),

row11 BIT STRING (SIZE (6)),

row12 BIT STRING (SIZE (6)),

row13 BIT STRING (SIZE (6)),

row14 BIT STRING (SIZE (6)),

row15 BIT STRING (SIZE (6)),

row16 BIT STRING (SIZE (6)),

row17 BIT STRING (SIZE (6)),

row18 BIT STRING (SIZE (6))

},

-- Time domain location for the first OFDM symbol of the CSI-RS resource relative to the start of the slot.

firstOFDM-SymbolInTimeDomain INTEGER (0..13),

-- Time domain location for the first OFDM symbol of the second pair of OFDM symbols in a 4-symbol resource if the two

-- symbol pairs are non-contiguous.

-- FFS\_RAN1: Check that this parameter is intended to be present also for ZP-CSI-RS-Resource.

firstOFDM-SymbolInTimeDomainSecondPair INTEGER (0..13) OPTIONAL, -- Need R

-- Density of ZP-CSI-RS resource measured in RE/port/PRB.

-- 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

-- Corresponds to L1 parameter 'ZP-CSI-RS-Density' (see 38.214, section FFS\_Section)

density CHOICE {

dot5 ENUMERATED {evenPRBs, oddPRBs},

one NULL,

three NULL,

spare NULL

},

-- Frequency-occupancy across PRBs of this ZP-CSI-RS-Resource.

-- Corresponds to L1 parameter 'ZP-CSI-RS-FreqBand' (see 38.214, section FFS\_Section)

freqBand CSI-FrequencyOccupation,

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

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

resourceType CHOICE {

aperiodic SEQUENCE {

...

},

periodic SEQUENCE {

-- Periodicity and slot offset for periodic ZP-CSI-RS resources.

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

periodicityAndOffset CSI-ResourcePeriodicityAndOffset,

...

}

},

...

}

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-ResourceIds*. 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 {1..maxNrofZP-CSI-RS-ResourcesPerSet) OF ZP-CSI-RS-ResourceId

...

}

-- 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-ResourceSetIds-1)

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

-- ASN1STOP

[UE capability information elements]