**3GPP TSG-RAN WG2 Meeting #111 electronic *R2-2008201***

**Online, August 17th – 28th, 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.331** | **CR** | **1533** | **rev** | **2** | **Current version:** | **16.1.0** |  |
|  | | | | | | | | |
| *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:*** | CLI configuration | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | LG Electronics | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_CLI\_RIM | | | | |  | ***Date:*** | | | 2020-08-19 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *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:*** | | RAN1 sent a reply LS (R1-2001319) providing clarifications on additional configuration for CLI resources. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Include BWP id and serving cell index in SRS resource configuration and include serving cell index in RSSI resource configuration.  **Impact Analysis**  Impacted 5G architecture options:  NR-SA, NR-DC, EN-DC  Impacted functionality:  CLI measurements  Inter-operability:  1. If the network is implemented according to the CR and the UE is not, the UE will ignore the new fields (i.e. refServCellIndex-r16 and refBWP-r16) and may fail to measure the CLI resource.  2. If the UE is implemented according to the CR and the network is not, the network will not configure the new fields (i.e. refServCellIndex-r16 and refBWP-r16) and UE may fail to measure the CLI resource. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The reference point of the CLI resources in frequency domain is not clear, so UE may fail to measure the CLI resource or measure wrong resource. | | | | | | | | |
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| ***Clauses affected:*** | | 5.5.1, 5.5.3.1, 6.3.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | | The ASN.1 changes are not backward-compatible with version 16.1.0. | | | | | | | | |
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| ***This CR's revision history:*** | | • “rev 1”: in-principle agreed CR R2-2004240 in RAN2#109bis-e.  • “rev 2”: update of the in-principle agreed CR to the latest specification version v16.1.0. | | | | | | | | |

### 5.5.1 Introduction

The network may configure an RRC\_CONNECTED UE to perform measurements. The network may configure the UE to report them in accordance with the measurement configuration or perform conditional reconfiguration evaluation in accordance with the conditional reconfiguration. The measurement configuration is provided by means of dedicated signalling i.e. using the *RRCReconfiguration* or *RRCResume.*

The network may configure the UE to perform the following types of measurements:

- NR measurements;

- Inter-RAT measurements of E-UTRA frequencies.

- Inter-RAT measurements of UTRA-FDD frequencies.

The network may configure the UE to report the following measurement information based on SS/PBCH block(s):

- Measurement results per SS/PBCH block;

- Measurement results per cell based on SS/PBCH block(s);

- SS/PBCH block(s) indexes.

The network may configure the UE to report the following measurement information based on CSI-RS resources:

- Measurement results per CSI-RS resource;

- Measurement results per cell based on CSI-RS resource(s);

- CSI-RS resource measurement identifiers.

The network may configure the UE to perform the following types of measurements for sidelink:

- CBR measurements.

The network may configure the UE to report the following CLI measurement information based on SRS resources:

- Measurement results per SRS resource;

- SRS resource(s) indexes.

The network may configure the UE to report the following CLI measurement information based on CLI-RSSI resources:

- Measurement results per CLI-RSSI resource;

- CLI-RSSI resource(s) indexes.

The measurement configuration includes the following parameters:

**1. Measurement objects:** A list of objects on which the UE shall perform the measurements.

- For intra-frequency and inter-frequency measurements a measurement object indicates the frequency/time location and subcarrier spacing of reference signals to be measured. Associated with this measurement object, the network may configure a list of cell specific offsets, a list of 'blacklisted' cells and a list of 'whitelisted' cells. Blacklisted cells are not applicable in event evaluation or measurement reporting. Whitelisted cells are the only ones applicable in event evaluation or measurement reporting.

- The *measObjectId* of the MO which corresponds to each serving cell is indicated by *servingCellMO* within the serving cell configuration.

- For inter-RAT E-UTRA measurements a measurement object is a single E-UTRA carrier frequency. Associated with this E-UTRA carrier frequency, the network can configure a list of cell specific offsets, a list of 'blacklisted' cells and a list of 'whitelisted' cells. Blacklisted cells are not applicable in event evaluation or measurement reporting. Whitelisted cells are the only ones applicable in event evaluation or measurement reporting.

- For inter-RAT UTRA-FDD measurements a measurement object is a set of cells on a single UTRA-FDD carrier frequency.

- For CBR measurement of NR sidelink communication, a measurement object is a set of transmission resource pool(s) on a single carrier frequency for NR sidelink communication.

- For CLI measurements a measurement object indicates the frequency/time location of SRS resources and/or CLI-RSSI resources, and subcarrier spacing of SRS resources to be measured.

**2. Reporting configurations:** A list of reporting configurations where there can be one or multiple reporting configurations per measurement object. Each measurement reporting configuration consists of the following:

- Reporting criterion: The criterion that triggers the UE to send a measurement report. This can either be periodical or a single event description.

- RS type: The RS that the UE uses for beam and cell measurement results (SS/PBCH block or CSI-RS).

- Reporting format: The quantities per cell and per beam that the UE includes in the measurement report (e.g. RSRP) and other associated information such as the maximum number of cells and the maximum number beams per cell to report.

In case of conditional reconfiguration triggering configuration, each configuration consists of the following:

- Execution criteria: The criteria that triggers the UE to perform conditional reconfiguration execution.

- RS type: The RS that the UE uses for beam and cell measurement results (SS/PBCH block or CSI-RS) for conditional reconfiguration execution condition.

**3. Measurement identities:** For measurement reporting, a list of measurement identities where each measurement identity links one measurement object with one reporting configuration. By configuring multiple measurement identities, it is possible to link more than one measurement object to the same reporting configuration, as well as to link more than one reporting configuration to the same measurement object. The measurement identity is also included in the measurement report that triggered the reporting, serving as a reference to the network. For conditional reconfiguration triggering, one measurement identity links to exactly one conditional reconfiguration trigger configuration. And up to 2 measurement identities can be linked to one conditional reconfiguration execution condition.

**4. Quantity configurations:** The quantity configuration defines the measurement filtering configuration used for all event evaluation and related reporting, and for periodical reporting of that measurement. For NR measurements, the network may configure up to 2 quantity configurations with a reference in the NR measurement object to the configuration that is to be used. In each configuration, different filter coefficients can be configured for different measurement quantities, for different RS types, and for measurements per cell and per beam.

**5. Measurement gaps:** Periods that the UE may use to perform measurements.

A UE in RRC\_CONNECTED maintains a measurement object list, a reporting configuration list, and a measurement identities list according to signalling and procedures in this specification. The measurement object list possibly includes NR measurement object(s), CLI measurement object(s) and inter-RAT objects. Similarly, the reporting configuration list includes NR and inter-RAT reporting configurations. Any measurement object can be linked to any reporting configuration of the same RAT type. Some reporting configurations may not be linked to a measurement object. Likewise, some measurement objects may not be linked to a reporting configuration.

The measurement procedures distinguish the following types of cells:

1. The NR serving cell(s) – these are the SpCell and one or more SCells.

2. Listed cells – these are cells listed within the measurement object(s).

3. Detected cells – these are cells that are not listed within the measurement object(s) but are detected by the UE on the SSB frequency(ies) and subcarrier spacing(s) indicated by the measurement object(s).

For NR measurement object(s), the UE measures and reports on the serving cell(s), listed cells and/or detected cells. For inter-RAT measurements object(s) of E-UTRA, the UE measures and reports on listed cells and detected cells and, for RSSI and channel occupancy measurements, the UE measures and reports on the configured resources on the indicated frequency. For inter-RAT measurements object(s) of UTRA-FDD, the UE measures and reports on listed cells. For CLI measurement object(s), the UE measures and reports on configured measurement resources (i.e. SRS resources and/or CLI-RSSI resources).

Whenever the procedural specification, other than contained in sub-clause 5.5.2, refers to a field it concerns a field included in the *VarMeasConfig* unless explicitly stated otherwise i.e. only the measurement configuration procedure covers the direct UE action related to the received *measConfig*.

In NR-DC, the UE may receive two independent *measConfig*:

- a *measConfig*, associated with MCG, that is included in the *RRCReconfiguration* message received via SRB1; and

- a *measConfig*, associated with SCG, that is included in the *RRCReconfiguration* message received via SRB3, or, alternatively, included within a *RRCReconfiguration* message embedded in a *RRCReconfiguration* message received via SRB1.

In this case, the UE maintains two independent *VarMeasConfig* and *VarMeasReportList*, one associated with each *measConfig*, and independently performs all the procedures in clause 5.5 for each *measConfig* and the associated *VarMeasConfig* and *VarMeasReportList*, unless explicitly stated otherwise.

The configurations related to CBR measurments are only included in the *measConfig* associated with MCG.

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| Unchanged parts are omitted |

#### 5.5.3.1 General

An RRC\_CONNECTED UE shall derive cell measurement results by measuring one or multiple beams associated per cell as configured by the network, as described in 5.5.3.3. For all cell measurement results, except for RSSI, and CLI measurement results in RRC\_CONNECTED, the UE applies the layer 3 filtering as specified in 5.5.3.2, before using the measured results for evaluation of reporting criteria, measurement reporting or the criteria to trigger conditional reconfiguration execution. For cell measurements, the network can configure RSRP, RSRQ, SINR, RSCP or EcN0 as trigger quantity. For CLI measurements, the network can configure SRS-RSRP or CLI-RSSI as trigger quantity. For cell and beam measurements, reporting quantities can be any combination of quantities (i.e. only RSRP; only RSRQ; only SINR; RSRP and RSRQ; RSRP and SINR; RSRQ and SINR; RSRP, RSRQ and SINR; only RSCP; only EcN0; RSCP and EcN0), irrespective of the trigger quantity, and for CLI measurements, reporting quantities can be either SRS-RSRP or CLI-RSSI. For conditional reconfiguration execution, the network can configure up to 2 quantities, both using same RS type. The UE does not apply the layer 3 filtering as specified in 5.5.3.2 to derive the CBR measurements.

The network may also configure the UE to report measurement information per beam (which can either be measurement results per beam with respective beam identifier(s) or only beam identifier(s)), derived as described in 5.5.3.3a. If beam measurement information is configured to be included in measurement reports, the UE applies the layer 3 beam filtering as specified in 5.5.3.2. On the other hand, the exact L1 filtering of beam measurements used to derive cell measurement results is implementation dependent.

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| Unchanged parts are omitted |

### 6.3.2 Radio resource control information elements

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| Unchanged parts are omitted |

#### *– MeasObjectCLI*

The IE *MeasObjectCLI* specifies information applicable for SRS-RSRP measurements and/or CLI-RSSI measurements.

*MeasObjectCLI* information element

-- ASN1START

-- TAG-MEASOBJECTCLI-START

MeasObjectCLI-r16 ::= SEQUENCE {

cli-ResourceConfig-r16 CLI-ResourceConfig-r16,

...

}

CLI-ResourceConfig-r16 ::= SEQUENCE {

srs-ResourceConfig-r16 SetupRelease { SRS-ResourceListConfigCLI-r16 } OPTIONAL, -- Need M

rssi-ResourceConfig-r16 SetupRelease { RSSI-ResourceListConfigCLI-r16 } OPTIONAL -- Need M

}

SRS-ResourceListConfigCLI-r16 ::= SEQUENCE (SIZE (1.. maxNrofCLI-SRS-Resources-r16)) OF SRS-ResourceConfigCLI-r16

RSSI-ResourceListConfigCLI-r16 ::= SEQUENCE (SIZE (1.. maxNrofCLI-RSSI-Resources-r16)) OF RSSI-ResourceConfigCLI-r16

SRS-ResourceConfigCLI-r16 ::= SEQUENCE {

srs-Resource-r16 SRS-Resource,

srs-SCS-r16 SubcarrierSpacing,

refServCellIndex-r16 ServCellIndex OPTIONAL, -- Need S

refBWP-r16 BWP-id,

...

}

RSSI-ResourceConfigCLI-r16 ::= SEQUENCE {

rssi-ResourceId-r16 RSSI-ResourceId-r16,

rssi-SCS-r16 SubcarrierSpacing,

startPRB-r16 INTEGER (0..2169),

nrofPRBs-r16 INTEGER (4..maxNrofPhysicalResourceBlocksPlus1),

startPosition-r16 INTEGER (0..13),

nrofSymbols-r16 INTEGER (1..14),

rssi-PeriodicityAndOffset-r16 RSSI-PeriodicityAndOffset-r16,

refServCellIndex-r16 ServCellIndex OPTIONAL, -- Need S

...

}

RSSI-ResourceId-r16 ::= INTEGER (0.. maxNrofCLI-RSSI-Resources-r16-1)

RSSI-PeriodicityAndOffset-r16 ::= CHOICE {

sl10 INTEGER(0..9),

sl20 INTEGER(0..19),

sl40 INTEGER(0..39),

sl80 INTEGER(0..79),

sl160 INTEGER(0..159),

sl320 INTEGER(0..319),

s1640 INTEGER(0..639),

...

}

-- TAG-MEASOBJECTCLI-STOP

-- ASN1STOP

|  |
| --- |
| *CLI-ResourceConfig* field descriptions |
| ***srs-ResourceConfig***  SRS resources to be used for CLI measurements. |
| ***rssi-ResourceConfig***  CLI-RSSI resources to be used for CLI measurements. |

|  |
| --- |
| *MeasObjectCLI* field descriptions |
| ***cli-ResourceConfig***  SRS and/or CLI-RSSI resource configuration for CLI measurement. |

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| *SRS-ResourceConfigCLI* field descriptions |
| ***refBWP***  DL BWP id that is used to derive the reference point of the SRS resource (see TS 38.211[16], clause 6.4.1.4.3) |
| ***refServCellIndex***  The index of the reference serving cell that the *refBWP* belongs to. If this field is absent, the reference serving cell is PCell. |
| ***srs-SCS***  Subcarrier spacing for SRS. Only the values 15, 30 kHz or 60 kHz (FR1), and 60 or 120 kHz (FR2) are applicable. |

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| *RSSI-ResourceConfigCLI* field descriptions |
| ***nrofPRBs***  Allowed size of the measurement BW. Only multiples of 4 are allowed. The smallest configurable number is the minimum of 4 and the width of the active DL BWP. If the configured value is larger than the width of the active DL BWP, the UE shall assume that the actual CLI-RSSI resource bandwidth is within the active DL BWP. |
| ***nrofSymbols***  Within a slot that is configured for CLI-RSSI measurement (see slotConfiguration), the UE measures the RSSI from *startPosition* to *startPosition* + *nrofSymbols* - 1. The configured CLI-RSSI resource does not exceed the slot boundary of the reference SCS. If the SCS of configured DL BWP(s) is larger than the reference SCS, network configures *startPosition* and *nrofSymbols* such that the configured CLI-RSSI resource not to exceed the slot boundary corresponding to the configuredBWP SCS. If the reference SCS is larger than SCS of configuredDL BWP(s), network ensures *startPosition* and *nrofSymbols* are integer multiple of reference SCS divided by configuredBWP SCS. |
| ***refServCellIndex***  The index of the reference serving cell. Frequency reference point of the RSSI resource is subcarrier 0 of CRB0 of the reference serving cell. If this field is absent, the reference serving cell is PCell. |
| ***rssi-PeriodicityAndOffset***  Periodicity and slot offset for this CLI-RSSI resource. All values are in "number of slots". Value *sl1* corresponds to a periodicity of 1 slot, value *sl2* corresponds to a periodicity of 2 slots, and so on. For each periodicity the corresponding offset is given in number of slots. |
| ***rssi-scs***  Reference subcarrier spacing for CLI-RSSI measurement. Only the values 15, 30 kHz or 60 kHz (FR1), and 60 or 120 kHz (FR2) are applicable. UE performs CLI-RSSI measurement with the SCS of the active bandwidth part within the configured CLI-RSSI resource in the active BWP regardless of the reference SCS of the measurement resource. |
| ***startPosition***  OFDM symbol location of the CLI-RSSI resource within a slot. |
| ***startPRB***  Starting PRB index of the measurement bandwidth. For the case where the reference subcarrier spacing is smaller than subcarrier spacing of active DL BWP(s), network configures startPRB and nrofPRBs are as a multiple of active BW SCS divided by reference SCS. |

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| Unchanged parts are omitted |

#### – *SRS-Config*

The IE *SRS-Config* is used to configure sounding reference signal transmissions. The configuration defines a list of SRS-Resources and a list of SRS-ResourceSets. Each resource set defines a set of SRS-Resources. The network triggers the transmission of the set of SRS-Resources using a configured aperiodicSRS-ResourceTrigger (L1 DCI).

*SRS-Config* information element

-- ASN1START

-- TAG-SRS-CONFIG-START

SRS-Config ::= SEQUENCE {

srs-ResourceSetToReleaseList SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceSetId OPTIONAL, -- Need N

srs-ResourceSetToAddModList SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceSet OPTIONAL, -- Need N

srs-ResourceToReleaseList SEQUENCE (SIZE(1..maxNrofSRS-Resources)) OF SRS-ResourceId OPTIONAL, -- Need N

srs-ResourceToAddModList SEQUENCE (SIZE(1..maxNrofSRS-Resources)) OF SRS-Resource OPTIONAL, -- Need N

tpc-Accumulation ENUMERATED {disabled} OPTIONAL, -- Need S

...,

[[

srs-RequestForDCI-Format1-2-r16 INTEGER (1..2) OPTIONAL, -- Need S

srs-RequestForDCI-Format0-2-r16 INTEGER (1..2) OPTIONAL, -- Need S

srs-ResourceSetToAddModListForDCI-Format0-2-r16 SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceSet OPTIONAL, -- Need N

srs-ResourceSetToReleaseListForDCI-Format0-2-r16 SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceSetId OPTIONAL,-- Need N

srs-PosResourceSetToReleaseList-r16 SEQUENCE (SIZE(1..maxNrofSRS-PosResourceSets-r16)) OF SRS-PosResourceSetId-r16

OPTIONAL, -- Need N

srs-PosResourceSetToAddModList-r16 SEQUENCE (SIZE(1..maxNrofSRS-PosResourceSets-r16)) OF SRS-PosResourceSet-r16 OPTIONAL,-- Need N

srs-PosResourceToReleaseList-r16 SEQUENCE (SIZE(1..maxNrofSRS-PosResources-r16)) OF SRS-PosResourceId-r16 OPTIONAL,-- Need N

srs-PosResourceToAddModList-r16 SEQUENCE (SIZE(1..maxNrofSRS-PosResources-r16)) OF SRS-PosResource-r16 OPTIONAL -- Need N

]]

}

SRS-ResourceSet ::= SEQUENCE {

srs-ResourceSetId SRS-ResourceSetId,

srs-ResourceIdList SEQUENCE (SIZE(1..maxNrofSRS-ResourcesPerSet)) OF SRS-ResourceId OPTIONAL, -- Cond Setup

resourceType CHOICE {

aperiodic SEQUENCE {

aperiodicSRS-ResourceTrigger INTEGER (1..maxNrofSRS-TriggerStates-1),

csi-RS NZP-CSI-RS-ResourceId OPTIONAL, -- Cond NonCodebook

slotOffset INTEGER (1..32) OPTIONAL, -- Need S

...,

[[

aperiodicSRS-ResourceTriggerList SEQUENCE (SIZE(1..maxNrofSRS-TriggerStates-2))

OF INTEGER (1..maxNrofSRS-TriggerStates-1) OPTIONAL -- Need M

]]

},

semi-persistent SEQUENCE {

associatedCSI-RS NZP-CSI-RS-ResourceId OPTIONAL, -- Cond NonCodebook

...

},

periodic SEQUENCE {

associatedCSI-RS NZP-CSI-RS-ResourceId OPTIONAL, -- Cond NonCodebook

...

}

},

usage ENUMERATED {beamManagement, codebook, nonCodebook, antennaSwitching},

alpha Alpha OPTIONAL, -- Need S

p0 INTEGER (-202..24) OPTIONAL, -- Cond Setup

pathlossReferenceRS PathlossReferenceRS-Config OPTIONAL, -- Need M

srs-PowerControlAdjustmentStates ENUMERATED { sameAsFci2, separateClosedLoop} OPTIONAL, -- Need S

...,

[[

pathlossReferenceRSList-r16 SetupRelease { PathlossReferenceRSList-r16} OPTIONAL -- Need M

]]

}

PathlossReferenceRS-Config ::= CHOICE {

ssb-Index SSB-Index,

csi-RS-Index NZP-CSI-RS-ResourceId

}

PathlossReferenceRSList-r16 ::= SEQUENCE (SIZE (1..maxNrofSRS-PathlossReferenceRS-r16)) OF PathlossReferenceRS-r16

PathlossReferenceRS-r16 ::= SEQUENCE {

srs-PathlossReferenceRS-Id-r16 SRS-PathlossReferenceRS-Id-r16,

pathlossReferenceRS-r16 PathlossReferenceRS-Config

}

SRS-PathlossReferenceRS-Id-r16 ::= INTEGER (0..maxNrofSRS-PathlossReferenceRS-1-r16)

SRS-PosResourceSet-r16 ::= SEQUENCE {

srs-PosResourceSetId-r16 SRS-PosResourceSetId-r16,

srs-PosResourceIdList-r16 SEQUENCE (SIZE(1..maxNrofSRS-ResourcesPerSet)) OF SRS-PosResourceId-r16

OPTIONAL, -- Cond Setup

resourceType-r16 CHOICE {

aperiodic-r16 SEQUENCE {

aperiodicSRS-ResourceTriggerList-r16 SEQUENCE (SIZE(1..maxNrofSRS-TriggerStates-1))

OF INTEGER (1..maxNrofSRS-TriggerStates-1) OPTIONAL, -- Need M

...

},

semi-persistent-r16 SEQUENCE {

...

},

periodic-r16 SEQUENCE {

...

}

},

alpha-r16 Alpha OPTIONAL, -- Need S

p0-r16 INTEGER (-202..24) OPTIONAL, -- Cond Setup

pathlossReferenceRS-Pos-r16 CHOICE {

ssb-IndexServing-r16 SSB-Index,

ssb-Ncell-r16 SSB-InfoNcell-r16,

dl-PRS-r16 DL-PRS-Info-r16

} OPTIONAL, -- Need M

...

}

SRS-ResourceSetId ::= INTEGER (0..maxNrofSRS-ResourceSets-1)

SRS-PosResourceSetId-r16 ::= INTEGER (0..maxNrofSRS-PosResourceSets-1-r16)

SRS-Resource ::= SEQUENCE {

srs-ResourceId SRS-ResourceId,

nrofSRS-Ports ENUMERATED {port1, ports2, ports4},

ptrs-PortIndex ENUMERATED {n0, n1 } OPTIONAL, -- Need R

transmissionComb CHOICE {

n2 SEQUENCE {

combOffset-n2 INTEGER (0..1),

cyclicShift-n2 INTEGER (0..7)

},

n4 SEQUENCE {

combOffset-n4 INTEGER (0..3),

cyclicShift-n4 INTEGER (0..11)

}

},

resourceMapping SEQUENCE {

startPosition INTEGER (0..5),

nrofSymbols ENUMERATED {n1, n2, n4},

repetitionFactor ENUMERATED {n1, n2, n4}

},

freqDomainPosition INTEGER (0..67),

freqDomainShift INTEGER (0..268),

freqHopping SEQUENCE {

c-SRS INTEGER (0..63),

b-SRS INTEGER (0..3),

b-hop INTEGER (0..3)

},

groupOrSequenceHopping ENUMERATED { neither, groupHopping, sequenceHopping },

resourceType CHOICE {

aperiodic SEQUENCE {

...

},

semi-persistent SEQUENCE {

periodicityAndOffset-sp SRS-PeriodicityAndOffset,

...

},

periodic SEQUENCE {

periodicityAndOffset-p SRS-PeriodicityAndOffset,

...

}

},

sequenceId INTEGER (0..1023),

spatialRelationInfo SRS-SpatialRelationInfo OPTIONAL, -- Need R

...,

[[

resourceMapping-r16 SEQUENCE {

startPosition-r16 INTEGER (0..13),

nrofSymbols-r16 ENUMERATED {n1, n2, n4},

repetitionFactor-r16 ENUMERATED {n1, n2, n4}

} OPTIONAL -- Need R

]]

}

SRS-PosResource-r16::= SEQUENCE {

srs-PosResourceId-r16 SRS-PosResourceId-r16,

transmissionComb-r16 CHOICE {

n2-r16 SEQUENCE {

combOffset-n2-r16 INTEGER (0..1),

cyclicShift-n2-r16 INTEGER (0..7)

},

n4-r16 SEQUENCE {

combOffset-n4-16 INTEGER (0..3),

cyclicShift-n4-r16 INTEGER (0..11)

},

n8-r16 SEQUENCE {

combOffset-n8-r16 INTEGER (0..7),

cyclicShift-n8-r16 INTEGER (0..5)

},

...

},

resourceMapping-r16 SEQUENCE {

startPosition-r16 INTEGER (0..13),

nrofSymbols-r16 ENUMERATED {n1, n2, n4, n8, n12}

},

freqDomainShift-r16 INTEGER (0..268),

freqHopping-r16 SEQUENCE {

c-SRS-r16 INTEGER (0..63),

...

},

groupOrSequenceHopping-r16 ENUMERATED { neither, groupHopping, sequenceHopping },

resourceType-r16 CHOICE {

aperiodic-r16 SEQUENCE {

slotOffset-r16 INTEGER (1..32) OPTIONAL, -- Need S

...

},

semi-persistent-r16 SEQUENCE {

periodicityAndOffset-sp-r16 SRS-PeriodicityAndOffset-r16,

...

},

periodic-r16 SEQUENCE {

periodicityAndOffset-p-r16 SRS-PeriodicityAndOffset-r16,

...

}

},

sequenceId-r16 INTEGER (0..65535),

spatialRelationInfoPos-r16 SRS-SpatialRelationInfoPos-r16 OPTIONAL, -- Need R

...

}

SRS-SpatialRelationInfo ::= SEQUENCE {

servingCellId ServCellIndex OPTIONAL, -- Need S

referenceSignal CHOICE {

ssb-Index SSB-Index,

csi-RS-Index NZP-CSI-RS-ResourceId,

srs SEQUENCE {

resourceId SRS-ResourceId,

uplinkBWP BWP-Id

}

}

}

SRS-SpatialRelationInfoPos-r16 ::= CHOICE {

servingRS-r16 SEQUENCE {

servingCellId ServCellIndex OPTIONAL, -- Need S

referenceSignal-r16 CHOICE {

ssb-IndexServing-r16 SSB-Index,

csi-RS-IndexServing-r16 NZP-CSI-RS-ResourceId,

srs-SpatialRelation-r16 SEQUENCE {

resourceSelection-r16 CHOICE {

srs-ResourceId-r16 SRS-ResourceId,

srs-PosResourceId-r16 SRS-PosResourceId-r16

},

uplinkBWP-r16 BWP-Id

}

}

},

ssb-Ncell-r16 SSB-InfoNcell-r16,

dl-PRS-r16 DL-PRS-Info-r16

}

SSB-Configuration-r16 ::= SEQUENCE {

ssb-Freq-r16 ARFCN-ValueNR,

halfFrameIndex-r16 ENUMERATED {zero, one},

ssbSubcarrierSpacing-r16 SubcarrierSpacing,

ssb-Periodicity-r16 ENUMERATED { ms5, ms10, ms20, ms40, ms80, ms160, spare2,spare1 } OPTIONAL, -- Need S

sfn0-Offset-r16 SEQUENCE {

sfn-Offset-r16 INTEGER (0..1023),

integerSubframeOffset-r16 INTEGER (0..9) OPTIONAL -- Need R

} OPTIONAL, -- Need R

sfn-SSB-Offset-r16 INTEGER (0..15),

ss-PBCH-BlockPower-r16 INTEGER (-60..50) OPTIONAL -- Cond Pathloss

}

SSB-InfoNcell-r16 ::= SEQUENCE {

physicalCellId-r16 PhysCellId,

ssb-IndexNcell-r16 SSB-Index OPTIONAL, -- Need S

ssb-Configuration-r16 SSB-Configuration-r16 OPTIONAL -- Need S

}

DL-PRS-Info-r16 ::= SEQUENCE {

dl-PRS-ID-r16 INTEGER (0..255),

dl-PRS-ResourceSetId-r16 INTEGER (0..7),

dl-PRS-ResourceId-r16 INTEGER (0..63) OPTIONAL -- Need S

}

SRS-ResourceId ::= INTEGER (0..maxNrofSRS-Resources-1)

SRS-PosResourceId-r16 ::= INTEGER (0..maxNrofSRS-PosResources-1-r16)

SRS-PeriodicityAndOffset ::= CHOICE {

sl1 NULL,

sl2 INTEGER(0..1),

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),

sl1280 INTEGER(0..1279),

sl2560 INTEGER(0..2559)

}

SRS-PeriodicityAndOffset-r16 ::= CHOICE {

sl1 NULL,

sl2 INTEGER(0..1),

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),

sl1280 INTEGER(0..1279),

sl2560 INTEGER(0..2559),

sl5120 INTEGER(0..5119),

sl10240 INTEGER(0..10239),

sl40960 INTEGER(0..40959),

sl81920 INTEGER(0..81919),

...

}

-- TAG-SRS-CONFIG-STOP

-- ASN1STOP

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| *SRS-Config* field descriptions |
| ***tpc-Accumulation***  If the field is absent, UE applies TPC commands via accumulation. If disabled, UE applies the TPC command without accumulation (this applies to SRS when a separate closed loop is configured for SRS) (see TS 38.213 [13], clause 7.3). |

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| *SRS-Resource* field descriptions |
| ***cyclicShift-n2***  Cyclic shift configuration (see TS 38.214 [19], clause 6.2.1). |
| ***cyclicShift-n4***  Cyclic shift configuration (see TS 38.214 [19], clause 6.2.1). |
| ***freqHopping***  Includes parameters capturing SRS frequency hopping (see TS 38.214 [19], clause 6.2.1). For CLI SRS-RSRP measurement, the network always configures this field such that *b-hop* > *b-SRS*. |
| ***groupOrSequenceHopping***  Parameter(s) for configuring group or sequence hopping (see TS 38.211 [16], clause 6.4.1.4.2). For CLI SRS-RSRP measurement, the network always configures this parameter to 'neither'. |
| ***nrofSRS-Ports***  Number of ports. For CLI SRS-RSRP measurement, the network always configures this parameter to 'port1'. |
| ***periodicityAndOffset-p***  Periodicity and slot offset for this SRS resource. All values are in "number of slots". Value *sl1* corresponds to a periodicity of 1 slot, value *sl2* corresponds to a periodicity of 2 slots, and so on. For each periodicity the corresponding offset is given in number of slots. For periodicity *sl1* the offset is 0 slots (see TS 38.214 [19], clause 6.2.1). For CLI SRS-RSRP measurement, *sl1280* and *sl2560* cannot be configured. |
| ***periodicityAndOffset-sp***  Periodicity and slot offset for this SRS resource. All values are in "number of slots". Value *sl1* corresponds to a periodicity of 1 slot, value *sl2* corresponds to a periodicity of 2 slots, and so on. For each periodicity the corresponding offset is given in number of slots. For periodicity *sl1* the offset is 0 slots (see TS 38.214 [19], clause 6.2.1). |
| ***ptrs-PortIndex***  The PTRS port index for this SRS resource for non-codebook based UL MIMO. This is only applicable when the corresponding *PTRS-UplinkConfig* is set to CP-OFDM. The *ptrs-PortIndex* configured here must be smaller than the *maxNrofPorts* configured in the *PTRS-UplinkConfig* (see TS 38.214 [19], clause 6.2.3.1). This parameter is not applicable to CLI SRS-RSRP measurement. |
| ***resourceMapping***  OFDM symbol location of the SRS resource within a slot including *nrofSymbols* (number of OFDM symbols), *startPosition* (value 0 refers to the last symbol, value 1 refers to the second last symbol, and so on) and *repetitionFactor* (see TS 38.214 [19], clause 6.2.1 and TS 38.211 [16], clause 6.4.1.4). The configured SRS resource does not exceed the slot boundary. If *resourceMapping-r16* is signalled, UE shall ignore the *resourceMapping* (without suffix). For CLI SRS-RSRP measurement, the network always configures *nrofSymbols* and *repetitionFactor* to 'n1'. |
| ***resourceType***  Periodicity and offset for semi-persistent and periodic SRS resource (see TS 38.214 [19], clause 6.2.1). For CLI SRS-RSRP measurement, only 'periodic' is applicable for *resourceType*. |
| ***sequenceId***  Sequence ID used to initialize pseudo random group and sequence hopping (see TS 38.214 [19], clause 6.2.1). |
| ***servingCellId***  The serving Cell ID of the source SSB, CSI-RS, or SRS for the spatial relation of the target SRS resource. If this field is absent the SSB, the CSI-RS, or the SRS is from the same serving cell where the SRS is configured. |
| ***spatialRelationInfo***  Configuration of the spatial relation between a reference RS and the target SRS. Reference RS can be SSB/CSI-RS/SRS (see TS 38.214 [19], clause 6.2.1). This parameter is not applicable to CLI SRS-RSRP measurement. |
| ***spatialRelationInfoPos***  Configuration of the spatial relation between a reference RS and the target SRS. Reference RS can be SSB/CSI-RS/SRS/DL-PRS (see TS 38.214 [19], clause 6.2.1). |
| ***srs-RequestForDCI-Format0-2***  Indicate the number of bits for "SRS request"in DCI format 0\_2. When the field is absent, then the value of 0 bit for "SRS request" in DCI format 0\_2 is applied. If the parameter *srs-RequestForDCI-Format0-2* is configured to value 1, 1 bit is used to indicate one of the first two rows of Table 7.3.1.1.2-24 in TS 38.212 [17] for triggered aperiodic SRS resource set. If the value 2 is configured, 2 bits are used to indicate one of the rows of Table 7.3.1.1.2-24 in TS 38.212 [17]. When UE is configured with *supplementaryUplink*, an extra bit (the first bit of the SRS request field) is used for the non-SUL/SUL indication. |
| ***srs-RequestForDCI-Format1-2***  Indicate the number of bits for "SRS request" in DCI format 1\_2. When the field is absent, then the value of 0 bit for "SRS request" in DCI format 1\_2 is applied. When the UE is configured with *supplementaryUplink*, an extra bit (the first bit of the SRS request field) is used for the non-SUL/SUL indication (see TS 38.214 [19], clause 6.1.1.2). |
| ***srs-ResourceSetToAddModListForDCI-Format0-2***  List of SRS resource set to be added or modified for DCI format 0\_2 (see TS 38.212 [17], clause 7.3.1). |
| ***srs-ResourceSetToReleaseListForDCI-Format0-2***  List of SRS resource set to be released for DCI format 0\_2 (see TS 38.212 [17], clause 7.3.1). |
| ***transmissionComb***  Comb value (2 or 4 or 8) and comb offset (0..combValue-1) (see TS 38.214 [19], clause 6.2.1). |

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| *SRS-ResourceSet* field descriptions |
| ***alpha***  alpha value for SRS power control (see TS 38.213 [13], clause 7.3). When the field is absent the UE applies the value 1. |
| ***aperiodicSRS-ResourceTriggerList***  An additional list of DCI "code points" upon which the UE shall transmit SRS according to this SRS resource set configuration (see TS 38.214 [19], clause 6.1.1.2). When the field is not included during a reconfiguration of *SRS-ResourceSet* of *resourceType* set to *aperiodic*, UE maintains this value based on the Need M; that is, this list is not considered as an extension of *aperiodicSRS-ResourceTrigger* for purpose of applying the general rule for extended list in clause 6.1.3. |
| ***aperiodicSRS-ResourceTrigger***  The DCI "code point" upon which the UE shall transmit SRS according to this SRS resource set configuration (see TS 38.214 [19], clause 6.1.1.2). |
| ***associatedCSI-RS***  ID of CSI-RS resource associated with this SRS resource set in non-codebook based operation (see TS 38.214 [19], clause 6.1.1.2). |
| ***csi-RS***  ID of CSI-RS resource associated with this SRS resource set. (see TS 38.214 [19], clause 6.1.1.2). |
| ***csi-RS-IndexServingcell***  Indicates CSI-RS index belonging to a serving cell |
| ***p0***  P0 value for SRS power control. The value is in dBm. Only even values (step size 2) are allowed (see TS 38.213 [13], clause 7.3). |
| ***pathlossReferenceRS***  A reference signal (e.g. a CSI-RS config or a SS block) to be used for SRS path loss estimation (see TS 38.213 [13], clause 7.3). |
| ***pathlossReferenceRS-Pos***  A reference signal (e.g. a SS block or a DL PRS config) to be used for SRS path loss estimation (see TS 38.213 [13], clause 7.3). |
| ***pathlossReferenceRSList***  Multiple candidate pathloss reference RS(s) for SRS power control, where one candidate RS can be mapped to SRS Resource Set via MAC CE (clause 6.1.3.27 in TS 38.321 [3]). The network can only configure this field if *pathlossReferenceRS* is not configured in the same *SRS-ResourceSet*. |
| ***resourceSelection***  Indicates whether the configured SRS spatial relation resource is a *SRS-Resource* or *SRS-PosResource*. |
| ***resourceType***  Time domain behavior of SRS resource configuration, see TS 38.214 [19], clause 6.2.1. The network configures SRS resources in the same resource set with the same time domain behavior on periodic, aperiodic and semi-persistent SRS. |
| ***slotOffset***  An offset in number of slots between the triggering DCI and the actual transmission of this *SRS-ResourceSet*. If the field is absent the UE applies no offset (value 0). |
| ***srs-PowerControlAdjustmentStates***  Indicates whether hsrs,c(i) = fc(i,1) or hsrs,c(i) = fc(i,2) (if twoPUSCH-PC-AdjustmentStates are configured) or separate close loop is configured for SRS. This parameter is applicable only for Uls on which UE also transmits PUSCH. If absent or release, the UE applies the value sameAs-Fci1 (see TS 38.213 [13], clause 7.3). |
| ***srs-ResourceIdList***  The IDs of the SRS-Resources used in this *SRS-ResourceSet*. If this *SRS-ResourceSet* is configured with usage set to codebook, the *srs-ResourceIdList* contains at most 2 entries. If this *SRS-ResourceSet* is configured with *usage* set to *nonCodebook*, the *srs-ResourceIdList* contains at most 4 entries. |
| ***srs-ResourceSetId***  The ID of this resource set. It is unique in the context of the BWP in which the parent *SRS-Config* is defined. |
| ***ssb-IndexSevingcell***  Indicates SSB index belonging to a serving cell |
| ***ssb-NCell***  This field indicates a SSB configuration from neighboring cell |
| ***usage***  Indicates if the SRS resource set is used for beam management, codebook based or non-codebook based transmission or antenna switching. See TS 38.214 [19], clause 6.2.1. Reconfiguration between codebook based and non-codebook based transmission is not supported. |
|  |

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| *SSB-InfoNCell* field descriptions |
| ***physicalCellId***  This field specifies the physical cell ID of the neighbour cell for which SSB configuration is provided. |
| ***ssb-IndexNcell***  This field specifies the index of the SSB for a neighbour cell. See TS 38.213 [13]. If this field is absent, the UE determines the *ssb-IndexNcell* of the *physicalCellId*  based on its SSB measurement from the cell. |
| ***ssb-Configuration***  This field specifies the full configuration of the SSB. If this field is absent, the UE obtains the configuration for the SSB from *nr-SSB-Config* received as part of DL PRS assistance data in LPP*,* see TS 37.355 [49], by looking up the corresponding SSB configuration using the field *physicalCellId*. |

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| *DL-PRS-Info* field descriptions |
| ***dl-PRS-ID***  This field specifies the UE specific TRP ID for which PRS configuration is provided. |
| ***dl-PRS-ResourceSetId***  This field specifies the PRS-ResourceSet ID of a PRS resourceSet. |
| ***Dl-PRS-ResourceId***  This field specifies the PRS-Resource ID of a PRS resource. If this field is absent, the UE determines the *dl-PRS-ResourceID* based on its PRS measurement from the TRP and DL PRS Resource Set. |

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| *SSB-Configuration* field descriptions |
| ***halfFrameIndex***  Indicates whether SSB is in the first half or the second half of the frame. Value zero indicates the first half and value 1 indicates the second half. |
| ***integerSubframeOffset***  Indicates the subframe boundary offset of the cell in which SSB is transmited. |
| ***sfn0-Offset***  Indiactes the time offset of the SFN0 slot 0 for the cell with respect to SFN0 slot 0 of serving cell. |
| ***sfn-Offset***  Indicates the 4 LSBs of the SFN of the cell in which SSB is transmitted. |
| ***ssb-Freq***  Indicates the frequency of the SSB. |
| ***ssb-PBCH-BlockPower***  Average EPRE of the resources elements that carry secondary synchronization signals in dBm that the NW used for SSB transmission, see TS 38.213 [13], clause 7. |
| ***ssb-Periodicity***  Indicates the periodicity of the SSB. If the field is absent, the UE applies the value ms5. (see TS 38.213 [13], clause 4.1) |
| ***ssbSubcarrierSpacing***  Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable. |

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| Conditional Presence | Explanation |
| *Setup* | This field is mandatory present upon configuration of *SRS-ResourceSet* or *SRS-Resource* and optionally present, Need M, otherwise. |
| *NonCodebook* | This field is optionally present, Need M, in case of non-codebook based transmission, otherwise the field is absent. |
| *Pathloss* | The field is mandatory present if the IE *SSB-InfoNcell* is included in *pathlossReferenceRS-Pos*; otherwise it is optionally present, Need R |