3GPP TSG-RAN WG2 Meeting #109-e R2-200xxxx

Electronic Meeting, 24th February – 6th March 2020

Agenda: 6.16.2

Source: Ericsson

Title: [AT109e][110][EMIMO] RRC CR (Ericsson)

Document for: Discussion, Decision

# Introduction

This document attempts to collects views as to help progress of eMIMO in RAN2-109-e according to below instructions:

* [AT109e][110][EMIMO] RRC CR (Ericsson)

Initial scope: Continue the discussion on RRC aspects, based on [R2-2001671](file:///C:\Data\3GPP\Extracts\R2-2001671%20-%20Summary%20of%20%5bNR%20eMIMO%5d%20RRC%20aspects_v3.docx)

Initial intended outcome:

* + - Set of proposals with full consensus (aim to agree to those over email)
    - Set of proposals that need further (online) discussion

First intermediate deadline: Tuesday 2020-02-25 20:00 CET

Final intended outcome: Agreed 38.331 CR

Final deadline: Thursday 2020-03-05 12:00 CET

Status: Started

# Background

R2-2001671 presented a summary for NR eMIMO RRC aspects. Under AI 6.16.2 the following documents were submitted:

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| [R2-2000860](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000860.zip) | Multiple rate matching patterns with M-TRP | Nokia, Nokia Shanghai Bell |
| [R2-2001036](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001036.zip) | Discussion the MIMO RRC parameter CRS pattern list | Qualcomm Incorporated |
| [R2-2001104](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001104.zip) | Proposals for [108#36][NR eMIMO] Running RRC CR (Ericsson) | Ericsson Limited |
| [R2-2001109](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001109.zip) | Running RRC CR for Introduction of NR eMIMO | Ericsson |
| [R2-2001345](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001345.zip) | Remaining RRC signalling aspects of NR eMIMO | Intel Corporation |

This summary is structured as follows: Section 2 discusses rate matching issue with review of R2-2000860 and R2-2001036. Section 3 discusses the rest of open issues based on R2-2001104. For the MAC CE related parameters addressed in R2-2001345 we suggest treating based on R2-2001345 if time allows. Slight preference is to wait for progress of the MAC CE discussions.

# 2 Handling of rate matching signalling

In R1-1913674 a rate matching related parameter is given under RAN1 TEI16:

|  |  |  |  |  |  |  |
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| Sub-feature group | Parameter name in the spec | New or existing? | Parameter name in the text | Description | Value range | Per (UE, cell, TRP, …) |
| Multiple LTE-CRS rate matching patterns | LTE-CRS-PatternList-r16 | New | LTE-CRS-PatternList-r16 | A list of LTE CRS patterns around which the UE shall do rate matching for PDSCH with 15 kHz subcarrier spacing. This list is not expected to be configured for a UE together with lte-CRS-ToMatchAround of ServingCellConfig or ServingCellConfigCommon. There may be up to three groups of CRS patterns where the groups are pair-wise non-overlapping in frequency and each group may consist of up to two CRS patterns that are fully overlapping in frequency. | SEQUENCE (SIZE (1..6)) OF RateMatchPatternLTE-CRS | per serving cell configuration |

Under eMIMO, the following parameter is given in the same excel:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sub-feature group | Parameter name in the spec | New or existing? | Parameter name in the text | Description | Value range | Per (UE, cell, TRP, …) |
| M-TRP | CRSPatternList- CORESETPoolIndex | New |  | ~~Agreement For multi-DCI based multi-TRP/panel transmission, the UE shall rate match around: Configured CRS patterns which optionally associated with a higher layer signaling index per CORESET (if configured) and are applied to the PDSCH scheduled with a DCI detected on a CORESET with the same higher layer index.~~ For mPDCCH based mPDSCH transmission, the UE shall rate match around configured CRS patterns which are associated with CORESETPoolIndex and are applied to the PDSCH scheduled with a DCI detected on a CORESET with the same value of CORESETPoolIndex. | ~~FFS~~ Up to RAN2 | per DL BWP |

Both [1][2] share the understanding that the total number of CRS patterns will be 6. Difference in the proposals comes in how to handle the association of a CRS pattern to CORESETPoolIndex and restrictions on how to enable the following:

There may be up to three groups of CRS patterns where the groups are pair-wise non-overlapping in frequency and each group may consist of up to two CRS patterns that are fully overlapping in frequency.

In [2], a list of CORESETPoolIndexes is suggested together with a limitation “The maximum of three CRS pattern associates to one CORESETPoolIndex.”

CRSPatternList-CORESETPoolIndex-r16    SEQUENCE (SIZE (1..6)) OF INTEGER (0，1)               OPTIONAL    -- Need N

This proposal does not seem to match with the limitation above. The limitation stated in RAN1 excel is about how CRS patterns are overlapping in frequency and not about exact CRS patterns. Further, by introducing a separate list of CORESETPoolIndexes that is suppose to match with the list of CRS patterns may result in tricky issues on ensuring that the intended matching between these lists is maintained correctly in RRC reconfigurations.

In [1], the association between CRS pattern and CORESETPoolIndex is done in a traditional way by adding the CORESETPoolIndex to each CRS pattern. This would avoid the issue of maintaining the mapping between the two separately configured lists (LTE-CRS-PatternList-r16 and CRSPatternList-CORESETPoolIndex-r16). However, the restrictions of configuring overlapping and non-overlapping CRS patterns in frequency was not implemented.

Our understanding is that as an NR carrier can overlap with maximum 3 LTE carriers, up to 3 CRS non overlapping patterns may be configured in case of single PDCCH. Then, as it could be possible that TRPs have different LTE cells as neighbours, the second PDCCH may be associated with different CRS pattern which is fully overlapping in frequency with the first PDCCH.

A CR for “Support of multiple LTE CRS rate matching patterns” was submitted to RAN2-109e in R2-2000865 with a note:

This CR only considers the non-overlapping case and the multi-TRP agreements in [R2-1912024](http://www.3gpp.org/ftp/tsg_ran/wg2_rl2/tsgr2_107bis/docs/R2-1912024.zip) ([R1-1909895](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1//TSGR1_98/Docs//R1-1909895.zip)) are assumed to be handled in the Rel-16 MIMO WID. The Rel-16 MIMO WID CR XXXX (R2-20xxxxx) also clashes with this CR, with the changes from that CR superseding the changes in this CR.

In there, a CRS pattern list of size 3 is introduced which would correspond to the non-overlapping CRS patterns(although in CR itself this requirement is not stated). Our proposal is to add another length 3 CRS pattern list that correspond to the CORESETPooIndex 1 if that is configured. In more detail, our suggested changes are as follows showing both changes by Nokia as in R2-2000865 and our additions:

*First Modified Subclause*

### 6.3.2 Radio resource control information elements

<UNNECESSARY PARTS OMITTED>

– *RateMatchPatternLTE-CRS*

The IE *RateMatchPatternLTE-CRS* is used to configure a pattern to rate match around LTE CRS. See TS 38.214 [19], clause 5.1.4.2.

***RateMatchPatternLTE-CRS* information element**

-- ASN1START

-- TAG-RATEMATCHPATTERNLTE-CRS-START

RateMatchPatternLTE-CRS ::= SEQUENCE {

carrierFreqDL INTEGER (0..16383),

carrierBandwidthDL ENUMERATED {n6, n15, n25, n50, n75, n100, spare2, spare1},

mbsfn-SubframeConfigList EUTRA-MBSFN-SubframeConfigList OPTIONAL, -- Need M

nrofCRS-Ports ENUMERATED {n1, n2, n4},

v-Shift ENUMERATED {n0, n1, n2, n3, n4, n5}

}

LTE-CRS-PatternList-r16 ::= SEQUENCE (SIZE (1..maxLTE-CRS-Patterns-r16)) OF RateMatchPatternLTE-CRS

-- TAG-RATEMATCHPATTERNLTE-CRS-STOP

-- ASN1STOP

|  |
| --- |
| ***RateMatchPatternLTE-CRS* field descriptions** |
| ***carrierBandwidthDL***  BW of the LTE carrier in number of PRBs (see TS 38.214 [19], clause 5.1.4.2). |
| ***carrierFreqDL***  Center of the LTE carrier (see TS 38.214 [19], clause 5.1.4.2). |
| ***mbsfn-SubframeConfigList***  LTE MBSFN subframe configuration (see TS 38.214 [19], clause 5.1.4.2). |
| ***nrofCRS-Ports***  Number of LTE CRS antenna port to rate-match around (see TS 38.214 [19], clause 5.1.4.2). |
| ***v-Shift***  Shifting value v-shift in LTE to rate match around LTE CRS (see TS 38.214 [19], clause 5.1.4.2). |

<UNNECESSARY PARTS OMITTED>

– *ServingCellConfig*

The IE *ServingCellConfig* is used to configure (add or modify) the UE with a serving cell, which may be the SpCell or an SCell of an MCG or SCG. The parameters herein are mostly UE specific but partly also cell specific (e.g. in additionally configured bandwidth parts). Reconfiguration between a PUCCH and PUCCHless SCell is only supported using an SCell release and add.

***ServingCellConfig* information element**

-- ASN1START

-- TAG-SERVINGCELLCONFIG-START

ServingCellConfig ::= SEQUENCE {

tdd-UL-DL-ConfigurationDedicated TDD-UL-DL-ConfigDedicated OPTIONAL, -- Cond TDD

initialDownlinkBWP BWP-DownlinkDedicated OPTIONAL, -- Need M

downlinkBWP-ToReleaseList SEQUENCE (SIZE (1..maxNrofBWPs)) OF BWP-Id OPTIONAL, -- Need N

downlinkBWP-ToAddModList SEQUENCE (SIZE (1..maxNrofBWPs)) OF BWP-Downlink OPTIONAL, -- Need N

firstActiveDownlinkBWP-Id BWP-Id OPTIONAL, -- Cond SyncAndCellAdd

bwp-InactivityTimer ENUMERATED {ms2, ms3, ms4, ms5, ms6, ms8, ms10, ms20, ms30,

ms40,ms50, ms60, ms80,ms100, ms200,ms300, ms500,

ms750, ms1280, ms1920, ms2560, spare10, spare9, spare8,

spare7, spare6, spare5, spare4, spare3, spare2, spare1 } OPTIONAL, --Need R

defaultDownlinkBWP-Id BWP-Id OPTIONAL, -- Need S

uplinkConfig UplinkConfig OPTIONAL, -- Need M

supplementaryUplink UplinkConfig OPTIONAL, -- Need M

pdcch-ServingCellConfig SetupRelease { PDCCH-ServingCellConfig } OPTIONAL, -- Need M

pdsch-ServingCellConfig SetupRelease { PDSCH-ServingCellConfig } OPTIONAL, -- Need M

csi-MeasConfig SetupRelease { CSI-MeasConfig } OPTIONAL, -- Need M

sCellDeactivationTimer ENUMERATED {ms20, ms40, ms80, ms160, ms200, ms240,

ms320, ms400, ms480, ms520, ms640, ms720,

ms840, ms1280, spare2,spare1} OPTIONAL, -- Cond ServingCellWithoutPUCCH

crossCarrierSchedulingConfig CrossCarrierSchedulingConfig OPTIONAL, -- Need M

tag-Id TAG-Id,

dummy ENUMERATED {enabled} OPTIONAL, -- Need R

pathlossReferenceLinking ENUMERATED {spCell, sCell} OPTIONAL, -- Cond SCellOnly

servingCellMO MeasObjectId OPTIONAL, -- Cond MeasObject

...,

[[

lte-CRS-ToMatchAround SetupRelease { RateMatchPatternLTE-CRS } OPTIONAL, -- Need M

rateMatchPatternToAddModList SEQUENCE (SIZE (1..maxNrofRateMatchPatterns)) OF RateMatchPattern OPTIONAL, -- Need N

rateMatchPatternToReleaseList SEQUENCE (SIZE (1..maxNrofRateMatchPatterns)) OF RateMatchPatternId OPTIONAL, -- Need N

downlinkChannelBW-PerSCS-List SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier OPTIONAL -- Need S

]],

[[

lte-CRS-PatternList-r16 SetupRelease { LTE-CRS-PatternList-r16 } OPTIONAL -- Cond LTE-CRS

lte-CRS-PatternListSecond-r16 SetupRelease { LTE-CRS-PatternList-r16 } OPTIONAL -- Cond CORESETPool

]]

}

UplinkConfig ::= SEQUENCE {

initialUplinkBWP BWP-UplinkDedicated OPTIONAL, -- Need M

uplinkBWP-ToReleaseList SEQUENCE (SIZE (1..maxNrofBWPs)) OF BWP-Id OPTIONAL, -- Need N

uplinkBWP-ToAddModList SEQUENCE (SIZE (1..maxNrofBWPs)) OF BWP-Uplink OPTIONAL, -- Need N

firstActiveUplinkBWP-Id BWP-Id OPTIONAL, -- Cond SyncAndCellAdd

pusch-ServingCellConfig SetupRelease { PUSCH-ServingCellConfig } OPTIONAL, -- Need M

carrierSwitching SetupRelease { SRS-CarrierSwitching } OPTIONAL, -- Need M

...,

[[

powerBoostPi2BPSK BOOLEAN OPTIONAL, -- Need M

uplinkChannelBW-PerSCS-List SEQUENCE (SIZE (1..maxSCSs)) OF SCS-SpecificCarrier OPTIONAL -- Need S

]]

}

-- TAG-SERVINGCELLCONFIG-STOP

-- ASN1STOP

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| ***ServingCellConfig* field descriptions** |
| ***bwp-InactivityTimer***  The duration in ms after which the UE falls back to the default Bandwidth Part (see TS 38.321 [3], clause 5.15). When the network releases the timer configuration, the UE stops the timer without switching to the default BWP. |
| ***crossCarrierSchedulingConfig***  Indicates whether this serving cell is cross-carrier scheduled by another serving cell or whether it cross-carrier schedules another serving cell. |
| ***defaultDownlinkBWP-Id***  The initial bandwidth part is referred to by BWP-Id = 0. ID of the downlink bandwidth part to be used upon expiry of the BWP inactivity timer. This field is UE specific. When the field is absent the UE uses the initial BWP as default BWP. (see TS 38.213 [13], clause 12 and TS 38.321 [3], clause 5.15). |
| ***downlinkBWP-ToAddModList***  List of additional downlink bandwidth parts to be added or modified. (see TS 38.213 [13], clause 12). |
| ***downlinkBWP-ToReleaseList***  List of additional downlink bandwidth parts to be released. (see TS 38.213 [13], clause 12). |
| ***downlinkChannelBW-PerSCS-List***  A set of UE specific channel bandwidth and location configurations for different subcarrier spacings (numerologies). Defined in relation to Point A. The UE uses the configuration provided in this field only for the purpose of channel bandwidth and location determination. If absent, UE uses the configuration indicated in *scs-SpecificCarrierList* in *DownlinkConfigCommon* / *DownlinkConfigCommonSIB*. Network only configures channel bandwidth that corresponds to the channel bandwidth values defined in TS 38.101-1 [15] and TS 38.101-2 [39]. |
| ***firstActiveDownlinkBWP-Id***  If configured for an SpCell, this field contains the ID of the DL BWP to be activated upon performing the RRC (re-)configuration. If the field is absent, the RRC (re-)configuration does not impose a BWP switch.  If configured for an SCell, this field contains the ID of the downlink bandwidth part to be used upon MAC-activation of an SCell. The initial bandwidth part is referred to by BWP-Id = 0.  Upon PCell change and PSCell addition/change, the network sets the *firstActiveDownlinkBWP-Id* and *firstActiveUplinkBWP-Id* to the same value. |
| ***initialDownlinkBWP***  The dedicated (UE-specific) configuration for the initial downlink bandwidth-part (i.e. DL BWP#0). If any of the optional IEs are configured within this IE, the UE considers the BWP#0 to be an RRC configured BWP (from UE capability viewpoint). Otherwise, the UE does not consider the BWP#0 as an RRC configured BWP (from UE capability viewpoint). Network always configures the UE with a value for this field if no other BWPs are configured. NOTE1 |
| ***lte-CRS-ToMatchAround***  Parameters to determine an LTE CRS pattern that the UE shall rate match around. |
| ***lte-CRS-PatternList***  A list of LTE CRS patterns around which the UE shall do rate matching for PDSCH. The LTE CRS patterns in this list shall be non-overlapping in frequency. |
| ***lte-CRS-PatternListSecond***  A list of LTE CRS patterns around which the UE shall do rate matching for PDSCH scheduled with a DCI detected on a CORESET with CORESETPoolIndex configured. This list is configured only if CORESETPoolIndex configured. The first LTE CRS pattern in this list shall be fully overlapping in frequency with the first LTE CRS pattern in lte-CRS-PatternList, The second LTE CRS pattern in this list shall be fully overlapping in frequency with the second LTE CRS pattern in lte-CRS-PatternList, and so on. |
| ***pathlossReferenceLinking***  Indicates whether UE shall apply as pathloss reference either the downlink of SpCell (PCell for MCG or PSCell for SCG) or of SCell that corresponds with this uplink (see TS 38.213 [13], clause 7). |
| ***pdsch-ServingCellConfig***  PDSCH related parameters that are not BWP-specific. |
| ***rateMatchPatternToAddModList***  Resources patterns which the UE should rate match PDSCH around. The UE rate matches around the union of all resources indicated in the rate match patterns. Rate match patterns defined here on cell level apply only to PDSCH of the same numerology. See TS 38.214 [19], clause 5.1.2.2.3. |
| ***sCellDeactivationTimer***  SCell deactivation timer in TS 38.321 [3]. If the field is absent, the UE applies the value infinity. |
| ***servingCellMO***  *measObjectId* of the *MeasObjectNR* in *MeasConfig* which is associated to the serving cell. For this *MeasObjectNR*, the following relationship applies between this MeasObjectNR and *frequencyInfoDL* in *ServingCellConfigCommon* of the serving cell: if *ssbFrequency* is configured, its value is the same as the *absoluteFrequencySSB* and if *csi-rs-ResourceConfigMobility* is configured, the value of its *subcarrierSpacing* is present in one entry of the *scs-SpecificCarrierList*, *csi-RS-CellListMobility* includes an entry corresponding to the serving cell (with *cellId* equal to *physCellId* in *ServingCellConfigCommon*) and the frequency range indicated by the *csi-rs-MeasurementBW* of the entry in *csi-RS-CellListMobility* is included in the frequency range indicated by in the entry of the *scs-SpecificCarrierList*. |
| ***supplementaryUplink***  Network may configure this field only when *supplementaryUplinkConfig* is configured in *ServingCellConfigCommon* or *ServingCellConfigCommonSIB*. |
| ***tag-Id***  Timing Advance Group ID, as specified in TS 38.321 [3], which this cell belongs to. |
| ***uplinkConfig***  Network may configure this field only when *uplinkConfigCommon* is configured in *ServingCellConfigCommon* or *ServingCellConfigCommonSIB*. |

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| ***UplinkConfig* field descriptions** |
| ***carrierSwitching***  Includes parameters for configuration of carrier based SRS switching (see TS 38.214 [19], clause 6.2.1.3. |
| ***firstActiveUplinkBWP-Id***  If configured for an SpCell, this field contains the ID of the UL BWP to be activated upon performing the RRC (re-)configuration. If the field is absent, the RRC (re-)configuration does not impose a BWP switch.  If configured for an SCell, this field contains the ID of the uplink bandwidth part to be used upon MAC-activation of an SCell. The initial bandwidth part is referred to by BandiwdthPartId = 0. |
| ***initialUplinkBWP***  The dedicated (UE-specific) configuration for the initial uplink bandwidth-part (i.e. UL BWP#0). If any of the optional IEs are configured within this IE as part of the IE *uplinkConfig*, the UE considers the BWP#0 to be an RRC configured BWP (from UE capability viewpoint). Otherwise, the UE does not consider the BWP#0 as an RRC configured BWP (from UE capability viewpoint). Network always configures the UE with a value for this field if no other BWPs are configured. NOTE1 |
| ***powerBoostPi2BPSK***  If this field is set to *true*, the UE determines the maximum output power for PUCCH/PUSCH transmissions that use pi/2 BPSK modulation according to TS 38.101-1 [15], clause 6.2.4. |
| ***pusch-ServingCellConfig***  PUSCH related parameters that are not BWP-specific. |
| ***uplinkBWP-ToAddModList***  The additional bandwidth parts for uplink to be added or modified. In case of TDD uplink- and downlink BWP with the same *bandwidthPartId* are considered as a BWP pair and must have the same center frequency. |
| ***uplinkBWP-ToReleaseList***  The additional bandwidth parts for uplink to be released. |
| ***uplinkChannelBW-PerSCS-List***  A set of UE specific channel bandwidth and location configurations for different subcarrier spacings (numerologies). Defined in relation to Point A. The UE uses the configuration provided in this field only for the purpose of channel bandwidth and location determination. If absent, UE uses the configuration indicated in *scs-SpecificCarrierList* in *UplinkConfigCommon* / *UplinkConfigCommonSIB*. Network only configures channel bandwidth that corresponds to the channel bandwidth values defined in TS 38.101-1 [15] and TS 38.101-2 [39]. |

NOTE 1: If the dedicated part of initial UL/DL BWP configuration is absent, the initial BWP can be used but with some limitations. For example, changing to another BWP requires *RRCReconfiguration* since DCI format 1\_0 doesn't support DCI-based switching.

|  |  |
| --- | --- |
| **Conditional Presence** | **Explanation** |
| *LTE-CRS* | This field is optionally present, Need M, if the field *lte-CRS-ToMatchAround* is not configured. It is absent otherwise. |
| *CORESETPool* | This field is optionally present, Need M, if the field *lte-CRS-ToMatchAround* is not configured and CORESETPoolIndex configured. It is absent otherwise. |
| *MeasObject* | This field is mandatory present for the SpCell if the UE has a *measConfig*, and it is optionally present, Need M, for SCells. |
| *SCellOnly* | This field is optionally present, Need R, for SCells. It is absent otherwise. |
| *ServingCellWithoutPUCCH* | This field is optionally present, Need S, for SCells except PUCCH SCells. It is absent otherwise. |
| *SyncAndCellAdd* | This field is mandatory present for a SpCell upon PCell change and PSCell addition/change and upon *RRCSetup*/*RRCResume*.  The field is mandatory present for an SCell upon addition.  For SpCell, the field is optionally present, Need N, upon reconfiguration without *reconfigurationWithSync*.  In all other cases the field is absent. |
| *TDD* | This field is optionally present, Need R, for TDD cells. It is absent otherwise. |

*Next Modified Subclause*

6.4 RRC multiplicity and type constraint values

– Multiplicity and type constraint definitions

-- ASN1START

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

maxBandComb INTEGER ::= 65536 -- Maximum number of DL band combinations

maxCellBlack INTEGER ::= 16 -- Maximum number of NR blacklisted cell ranges in SIB3, SIB4

maxCellInter INTEGER ::= 16 -- Maximum number of inter-Freq cells listed in SIB4

maxCellIntra INTEGER ::= 16 -- Maximum number of intra-Freq cells listed in SIB3

maxCellMeasEUTRA INTEGER ::= 32 -- Maximum number of cells in E-UTRAN

maxEARFCN INTEGER ::= 262143 -- Maximum value of E-UTRA carrier frequency

maxEUTRA-CellBlack INTEGER ::= 16 -- Maximum number of E-UTRA blacklisted physical cell identity ranges

-- in SIB5

maxEUTRA-NS-Pmax INTEGER ::= 8 -- Maximum number of NS and P-Max values per band

maxMultiBands INTEGER ::= 8 -- Maximum number of additional frequency bands that a cell belongs to

maxNARFCN INTEGER ::= 3279165 -- Maximum value of NR carrier frequency

maxNR-NS-Pmax INTEGER ::= 8 -- Maximum number of NS and P-Max values per band

maxNrofServingCells INTEGER ::= 32 -- Max number of serving cells (SpCells + SCells)

maxNrofServingCells-1 INTEGER ::= 31 -- Max number of serving cells (SpCell + SCells) per cell group

maxNrofAggregatedCellsPerCellGroup INTEGER ::= 16

maxNrofSCells INTEGER ::= 31 -- Max number of secondary serving cells per cell group

maxNrofCellMeas INTEGER ::= 32 -- Maximum number of entries in each of the cell lists in a measurement

-- object

maxNrofSS-BlocksToAverage INTEGER ::= 16 -- Max number for the (max) number of SS blocks to average to determine cell

-- measurement

maxNrofCSI-RS-ResourcesToAverage INTEGER ::= 16 -- Max number for the (max) number of CSI-RS to average to determine cell

-- measurement

maxNrofDL-Allocations INTEGER ::= 16 -- Maximum number of PDSCH time domain resource allocations

maxNrofSR-ConfigPerCellGroup INTEGER ::= 8 -- Maximum number of SR configurations per cell group

maxLCG-ID INTEGER ::= 7 -- Maximum value of LCG ID

maxLC-ID INTEGER ::= 32 -- Maximum value of Logical Channel ID

maxLTE-CRS-Patterns-r16 INTEGER ::= 3 -- Maximum number of additional LTE CRS rate matching patterns

maxNrofTAGs INTEGER ::= 4 -- Maximum number of Timing Advance Groups

maxNrofTAGs-1 INTEGER ::= 3 -- Maximum number of Timing Advance Groups minus 1

maxNrofBWPs INTEGER ::= 4 -- Maximum number of BWPs per serving cell

maxNrofCombIDC INTEGER ::= 128 -- Maximum number of reported MR-DC combinations for IDC

maxNrofSymbols-1 INTEGER ::= 13 -- Maximum index identifying a symbol within a slot (14 symbols, indexed

-- from 0..13)

maxNrofSlots INTEGER ::= 320 -- Maximum number of slots in a 10 ms period

maxNrofSlots-1 INTEGER ::= 319 -- Maximum number of slots in a 10 ms period minus 1

maxNrofPhysicalResourceBlocks INTEGER ::= 275 -- Maximum number of PRBs

maxNrofPhysicalResourceBlocks-1 INTEGER ::= 274 -- Maximum number of PRBs minus 1

maxNrofPhysicalResourceBlocksPlus1 INTEGER ::= 276 -- Maximum number of PRBs plus 1

maxNrofControlResourceSets-1 INTEGER ::= 11 -- Max number of CoReSets configurable on a serving cell minus 1

maxCoReSetDuration INTEGER ::= 3 -- Max number of OFDM symbols in a control resource set

maxNrofSearchSpaces-1 INTEGER ::= 39 -- Max number of Search Spaces minus 1

maxSFI-DCI-PayloadSize INTEGER ::= 128 -- Max number payload of a DCI scrambled with SFI-RNTI

maxSFI-DCI-PayloadSize-1 INTEGER ::= 127 -- Max number payload of a DCI scrambled with SFI-RNTI minus 1

maxINT-DCI-PayloadSize INTEGER ::= 126 -- Max number payload of a DCI scrambled with INT-RNTI

maxINT-DCI-PayloadSize-1 INTEGER ::= 125 -- Max number payload of a DCI scrambled with INT-RNTI minus 1

maxNrofRateMatchPatterns INTEGER ::= 4 -- Max number of rate matching patterns that may be configured

maxNrofRateMatchPatterns-1 INTEGER ::= 3 -- Max number of rate matching patterns that may be configured minus 1

maxNrofRateMatchPatternsPerGroup INTEGER ::= 8 -- Max number of rate matching patterns that may be configured in one group

maxNrofCSI-ReportConfigurations INTEGER ::= 48 -- Maximum number of report configurations

maxNrofCSI-ReportConfigurations-1 INTEGER ::= 47 -- Maximum number of report configurations minus 1

maxNrofCSI-ResourceConfigurations INTEGER ::= 112 -- Maximum number of resource configurations

maxNrofCSI-ResourceConfigurations-1 INTEGER ::= 111 -- Maximum number of resource configurations minus 1

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 per trigger state for aperiodic

-- reporting

maxNrofNZP-CSI-RS-Resources INTEGER ::= 192 -- Maximum number of Non-Zero-Power (NZP) CSI-RS resources

maxNrofNZP-CSI-RS-Resources-1 INTEGER ::= 191 -- Maximum number of Non-Zero-Power (NZP) CSI-RS resources minus 1

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

maxNrofNZP-CSI-RS-ResourceSets INTEGER ::= 64 -- Maximum number of NZP CSI-RS resources per cell

maxNrofNZP-CSI-RS-ResourceSets-1 INTEGER ::= 63 -- Maximum number of NZP CSI-RS resources per cell minus 1

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

maxNrofNZP-CSI-RS-ResourcesPerConfig INTEGER ::= 128 -- Maximum number of resources per resource configuration

maxNrofZP-CSI-RS-Resources INTEGER ::= 32 -- Maximum number of Zero-Power (ZP) CSI-RS resources

maxNrofZP-CSI-RS-Resources-1 INTEGER ::= 31 -- Maximum number of Zero-Power (ZP) CSI-RS resources minus 1

maxNrofZP-CSI-RS-ResourceSets-1 INTEGER ::= 15

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

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

maxNrofCSI-IM-Resources INTEGER ::= 32 -- Maximum number of CSI-IM resources. See CSI-IM-ResourceMax in 38.214.

maxNrofCSI-IM-Resources-1 INTEGER ::= 31 -- Maximum number of CSI-IM resources minus 1. See CSI-IM-ResourceMax

-- in 38.214.

maxNrofCSI-IM-ResourcesPerSet INTEGER ::= 8 -- Maximum number of CSI-IM resources per set. See CSI-IM-ResourcePerSetMax

-- in 38.214

maxNrofCSI-IM-ResourceSets INTEGER ::= 64 -- Maximum number of NZP CSI-IM resources per cell

maxNrofCSI-IM-ResourceSets-1 INTEGER ::= 63 -- Maximum number of NZP CSI-IM resources per cell minus 1

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

maxNrofCSI-SSB-ResourcePerSet INTEGER ::= 64 -- Maximum number of SSB resources in a resource set

maxNrofCSI-SSB-ResourceSets INTEGER ::= 64 -- Maximum number of CSI SSB resource sets per cell

maxNrofCSI-SSB-ResourceSets-1 INTEGER ::= 63 -- Maximum number of CSI SSB resource sets per cell minus 1

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

maxNrofFailureDetectionResources INTEGER ::= 10 -- Maximum number of failure detection resources

maxNrofFailureDetectionResources-1 INTEGER ::= 9 -- Maximum number of failure detection resources minus 1

maxNrofObjectId INTEGER ::= 64 -- Maximum number of measurement objects

maxNrofPageRec INTEGER ::= 32 -- Maximum number of page records

maxNrofPCI-Ranges INTEGER ::= 8 -- Maximum number of PCI ranges

maxPLMN INTEGER ::= 12 -- Maximum number of PLMNs broadcast and reported by UE at establisghment

maxNrofCSI-RS-ResourcesRRM INTEGER ::= 96 -- Maximum number of CSI-RS resources for an RRM measurement object

maxNrofCSI-RS-ResourcesRRM-1 INTEGER ::= 95 -- Maximum number of CSI-RS resources for an RRM measurement object minus 1

maxNrofMeasId INTEGER ::= 64 -- Maximum number of configured measurements

maxNrofQuantityConfig INTEGER ::= 2 -- Maximum number of quantity configurations

maxNrofCSI-RS-CellsRRM INTEGER ::= 96 -- Maximum number of cells with CSI-RS resources for an RRM measurement

-- object

maxNrofSRS-ResourceSets INTEGER ::= 16 -- Maximum number of SRS resource sets in a BWP.

maxNrofSRS-ResourceSets-1 INTEGER ::= 15 -- Maximum number of SRS resource sets in a BWP minus 1.

maxNrofSRS-Resources INTEGER ::= 64 -- Maximum number of SRS resources.

maxNrofSRS-Resources-1 INTEGER ::= 63 -- Maximum number of SRS resources in an SRS resource set minus 1.

maxNrofSRS-ResourcesPerSet INTEGER ::= 16 -- Maximum number of SRS resources in an SRS resource set

maxNrofSRS-TriggerStates-1 INTEGER ::= 3 -- Maximum number of SRS trigger states minus 1, i.e., the largest code

-- point.

maxNrofSRS-TriggerStates-2 INTEGER ::= 2 -- Maximum number of SRS trigger states minus 2.

maxRAT-CapabilityContainers INTEGER ::= 8 -- Maximum number of interworking RAT containers (incl NR and MRDC)

maxSimultaneousBands INTEGER ::= 32 -- Maximum number of simultaneously aggregated bands

maxNrofSlotFormatCombinationsPerSet INTEGER ::= 512 -- Maximum number of Slot Format Combinations in a SF-Set.

maxNrofSlotFormatCombinationsPerSet-1 INTEGER ::= 511 -- Maximum number of Slot Format Combinations in a SF-Set minus 1.

maxNrofPUCCH-Resources INTEGER ::= 128

maxNrofPUCCH-Resources-1 INTEGER ::= 127

maxNrofPUCCH-ResourceSets INTEGER ::= 4 -- Maximum number of PUCCH Resource Sets

maxNrofPUCCH-ResourceSets-1 INTEGER ::= 3 -- Maximum number of PUCCH Resource Sets minus 1.

maxNrofPUCCH-ResourcesPerSet INTEGER ::= 32 -- Maximum number of PUCCH Resources per PUCCH-ResourceSet

maxNrofPUCCH-P0-PerSet INTEGER ::= 8 -- Maximum number of P0-pucch present in a p0-pucch set

maxNrofPUCCH-PathlossReferenceRSs INTEGER ::= 4 -- Maximum number of RSs used as pathloss reference for PUCCH power control.

maxNrofPUCCH-PathlossReferenceRSs-1 INTEGER ::= 3 -- Maximum number of RSs used as pathloss reference for PUCCH power

-- control minus 1.

maxNrofP0-PUSCH-AlphaSets INTEGER ::= 30 -- Maximum number of P0-pusch-alpha-sets (see 38,213, clause 7.1)

maxNrofP0-PUSCH-AlphaSets-1 INTEGER ::= 29 -- Maximum number of P0-pusch-alpha-sets minus 1 (see 38,213, clause 7.1)

maxNrofPUSCH-PathlossReferenceRSs INTEGER ::= 4 -- Maximum number of RSs used as pathloss reference for PUSCH power control.

maxNrofPUSCH-PathlossReferenceRSs-1 INTEGER ::= 3 -- Maximum number of RSs used as pathloss reference for PUSCH power

-- control minus 1.

maxNrofNAICS-Entries INTEGER ::= 8 -- Maximum number of supported NAICS capability set

maxBands INTEGER ::= 1024 -- Maximum number of supported bands in UE capability.

maxBandsMRDC INTEGER ::= 1280

maxBandsEUTRA INTEGER ::= 256

maxCellReport INTEGER ::= 8

maxDRB INTEGER ::= 29 -- Maximum number of DRBs (that can be added in DRB-ToAddModLIst).

maxFreq INTEGER ::= 8 -- Max number of frequencies.

maxFreqIDC-MRDC INTEGER ::= 32 -- Maximum number of candidate NR frequencies for MR-DC IDC indication

maxNrofCandidateBeams INTEGER ::= 16 -- Max number of PRACH-ResourceDedicatedBFR that in BFR config.

maxNrofPCIsPerSMTC INTEGER ::= 64 -- Maximun number of PCIs per SMTC.

maxNrofQFIs INTEGER ::= 64

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

maxNrofSR-Resources INTEGER ::= 8 -- Maximum number of SR resources per BWP in a cell.

maxNrofSlotFormatsPerCombination INTEGER ::= 256

maxNrofSpatialRelationInfos INTEGER ::= 8

maxNrofIndexesToReport INTEGER ::= 32

maxNrofIndexesToReport2 INTEGER ::= 64

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

maxNrofS-NSSAI INTEGER ::= 8 -- Maximum number of S-NSSAI.

maxNrofTCI-StatesPDCCH INTEGER ::= 64

maxNrofTCI-States INTEGER ::= 128 -- Maximum number of TCI states.

maxNrofTCI-States-1 INTEGER ::= 127 -- Maximum number of TCI states minus 1.

maxNrofUL-Allocations INTEGER ::= 16 -- Maximum number of PUSCH time domain resource allocations.

maxQFI INTEGER ::= 63

maxRA-CSIRS-Resources INTEGER ::= 96

maxRA-OccasionsPerCSIRS INTEGER ::= 64 -- Maximum number of RA occasions for one CSI-RS

maxRA-Occasions-1 INTEGER ::= 511 -- Maximum number of RA occasions in the system

maxRA-SSB-Resources INTEGER ::= 64

maxSCSs INTEGER ::= 5

maxSecondaryCellGroups INTEGER ::= 3

maxNrofServingCellsEUTRA INTEGER ::= 32

maxMBSFN-Allocations INTEGER ::= 8

maxNrofMultiBands INTEGER ::= 8

maxCellSFTD INTEGER ::= 3 -- Maximum number of cells for SFTD reporting

maxReportConfigId INTEGER ::= 64

maxNrofCodebooks INTEGER ::= 16 -- Maximum number of codebooks suppoted by the UE

maxNrofCSI-RS-Resources INTEGER ::= 7 -- Maximum number of codebook resources supported by the UE

maxNrofSRI-PUSCH-Mappings INTEGER ::= 16

maxNrofSRI-PUSCH-Mappings-1 INTEGER ::= 15

maxSIB INTEGER::= 32 -- Maximum number of SIBs

maxSI-Message INTEGER::= 32 -- Maximum number of SI messages

maxPO-perPF INTEGER ::= 4 -- Maximum number of paging occasion per paging frame

maxAccessCat-1 INTEGER ::= 63 -- Maximum number of Access Categories minus 1

maxBarringInfoSet INTEGER ::= 8 -- Maximum number of Access Categories

maxCellEUTRA INTEGER ::= 8 -- Maximum number of E-UTRA cells in SIB list

maxEUTRA-Carrier INTEGER ::= 8 -- Maximum number of E-UTRA carriers in SIB list

maxPLMNIdentities INTEGER ::= 8 -- Maximum number of PLMN identites in RAN area configurations

maxDownlinkFeatureSets INTEGER ::= 1024 -- (for NR DL) Total number of FeatureSets (size of the pool)

maxUplinkFeatureSets INTEGER ::= 1024 -- (for NR UL) Total number of FeatureSets (size of the pool)

maxEUTRA-DL-FeatureSets INTEGER ::= 256 -- (for E-UTRA) Total number of FeatureSets (size of the pool)

maxEUTRA-UL-FeatureSets INTEGER ::= 256 -- (for E-UTRA) Total number of FeatureSets (size of the pool)

maxFeatureSetsPerBand INTEGER ::= 128 -- (for NR) The number of feature sets associated with one band.

maxPerCC-FeatureSets INTEGER ::= 1024 -- (for NR) Total number of CC-specific FeatureSets (size of the pool)

maxFeatureSetCombinations INTEGER ::= 1024 -- (for MR-DC/NR)Total number of Feature set combinations (size of the

-- pool)

maxInterRAT-RSTD-Freq INTEGER ::= 3

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

-- ASN1STOP

*End*

Capabilities are left out from this discussion on purpose. If the above is agreeable, there could be capability related to the lte-CRS-PatternListSecond. Proposal is to agree to implement the above changes in running RRC CR for NR eMIMO.

1. Agree to implement two LTE CRS pattern lists corresponding to each CORESETPoolIndex as indicated in above changes and merge the changes to the running RRC CR for NR eMIMO

**Q1: Companies are asked give their views on Proposal 1 on whether they think it could be agreed over email or whether it should be discussed online taking into account the chairman’s guidance as below:**

* + - Set of proposals with full consensus (aim to agree to those over email)
    - Set of proposals that need further (online) discussion

|  |  |  |
| --- | --- | --- |
| Company | Online/email | Comments on Proposal 1 |
| Samsung | Email or online | Generally agree to use two LTE CRS pattern list but some question/suggestion for the modeling of signaling.  Questions for the example when only one CORESETPoolIndex is configured in a cell:  Cell A: CORESETPoolIndex 0, 1  Cell B: CORESETPoolIndex 0  Cell C: CORESETPoolIndex 1  From my understanding, lte-CRS-PatternListSecond is configured for both green-highlighted cases i.e. not configuring lte-CRS-PatternList.  We think it is better to use lte-CRS-PatternListSecond only for the case of yellow highlighted i.e. for green-highlighted cases, lte-CRS-PatternList is used instaed of lte-CRS-PatternListSecond.  Maybe it is just modelling issue but better to capture the RAN1 agreements. |
| Ericsson | As per consensus | Repeating the reply to Samsung here:  I think we have same intention. To our understanding CORESETPolIndex is configured only with yellow highlited case and thus it would follow also list Second is configured only in that case. Further, to my understanding, the green case does not exist. If a cell has only one CORESETPool, CORESETPoolIndex is not configured and the cell is in singlePDCCH mode. When CORESETPoolINDEX is configured, it can only have value 1 and the first one has assumes then value 0. That is, according to current RRC implementation proposal. |
| Nokia | Either | We think the single list is still far simpler and avoids any of the issues raised by Samsung: What is important is that 1) UE capabilities are clear in how many rate matching patterns UE supports and 2) network is able to configure the patterns in all cases. We don’t see big issues for either, which is why we introduced one list.  If we ever need to increase the list sizes, we will also have to have separate lists for the ”1st” and ”2nd” lists, and if we ever add the ”3rd” list, that will also require a separate entry. |
| Qualcomm | Email or online | Fine to add the second lte-CRS-PatternList with length 3 LTE-CRS pattern list that corresponds to the CORESETPooIndex 1 if it is configured.  The maximum of three CRS pattern associates to one CORESETPoolIndex should be maintained to align with RAN1 agreements.  Since the change is also related to the new added parameter lte-CRS-PatternList-r16, it is suggested to discuss together. |
| Intel | *Email or online* | *We echo Nokia;s views.* |
| Huawei | Email or online (but RAN1 to confirm) | The lte-CRS-PatternList(Second) is proposed to be configured per serving cell so we don't understand the comment from Samsung where it seems that 3 serving cells share the same lte-CRS-PatternList.  In our understanding, the lte-CRS-PatternList is used for transmissions scheduled via a CORESET belonging to pool 0 and the lte-CRS-PatternListSecond is used for transmissions scheduled via a CORESET belonging to pool 1. This should probably be captured. |
|  |  |  |

# 3 Open issues in current running RRC CR

Here we are lifting issues from [3] that we feel could be attempted to be discussed and agreed during the e-meeting.

#### UL full power transmission

The excel gives the ULFTX parameter as follows:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ULFPTxModes | new |  | gNB configures UE to support UL full power transmission with Mode1 or Mode2. Note 1: whether this can be combined in ULFPTx or not is up to RAN2. Note 2: if ULFPTx is configured while ULFPTxModes is not configured, UE delivers full power in another operation mode other than mode 1 and mode 2. | {Mode1, Mode2} |  | Per UL BWP | UE-specific |  | If UE only supports Mode 1 gNB cannot configure this UE to operate in Mode 2, if UE only supports Mode 2 gNB cannot configure this UE to operate in Mode 1 |

While ‘mode 1’ and ‘mode 2’ are defined in the excel, we have essentially 3 modes of operation:

1. Where UE has full power PAs on all Tx chains, and transmits full power regardless of which TPMIs are used
2. Mode 1: where the UE uses a new codebook subset to virtualize low power Tx chains to produce full power
3. Mode 2: where the UE may use different size SRS resources to support virtualization of low power Tx chains and/or indicate that is supports full power with certain ‘selection’ TPMIs (to exploit the use of some Tx chains that can deliver full power).

A related agreement from RAN1#98bis is:

[R1-1910561](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_98b/Docs/R1-1910561.zip)        Feature lead summary on UL full power TX           vivo

[R1-1911452](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_98b/Docs/R1-1911452.zip)        Summary#1 of offline discussion on Full TX Power UL      vivo

**Agreement**

* Support RRC configuration to operate in Mode1 or Mode2 subject to UE capability
  + For UE capabilty-2 and-3, gNB can configure a UE to operate in Mode 1 or Mode 2 subject to UE capability
    - Note : if UE only supports Mode 1 gNB cannot configure this UE to operate in Mode 2, if UE only supports Mode 2 gNB cannot configure this UE to operate in Mode 1
  + FFS: UE capability signaling discussion
  + Note: capability-1 UE can be configured with RRC parameter “ULFPTx” to deliver UL full power has been agreed, exact parameter name is up to RAN2
* If gNB does not configure UE for Rel-16 full power UL transmission, Rel-16 UEs operate in Rel-15 behavior

Based on the above understanding, three parameters are implemented in [4] as ENUMERATE{fullpower, fullpowerMode1, fullpoweMode2}.

It is true that a change to 38.213 would be needed to align with a 3-mode structure, but that is a consequence of Note 1, where it was left to RAN2 to decide to merge to 1 parameter or not.

The needed changes to 38.213 are shown below.  Looking at 213, it looks more clear to have 3 modes and one parameter, since there are 3 sub-bullets describing 3 power scaling behaviors.  Using two parameters and not providing one of them as a way of indicating the third mode is doable, but somewhat confusing.  This again is why there is the Note 1, and Note 2 saying that there is a third operation mode.

It is hard to understand why two parameters are needed or beneficial to describe the operation.

Needed changes to 38213:

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7.1       Physical uplink shared channel

For a PUSCH transmission on active UL BWP , as described in Clause 12, of carrier  of serving cell , a UE first calculates a linear value  of the transmit power , with parameters as defined in Clause 7.1.1. For a PUSCH transmission scheduled by a DCI format or configured by *ConfiguredGrantConfig* or *semiPersistentOnPUSCH*, if *txConfig* in *PUSCH-Config* is set to 'codebook',

-    if ul-FullPowerTransmission in PUSCH-Config is provided and codebookSubset in PUSCH-Config is set to nonCoherent or partialAndNonCoherent, the UE scales by where:

-     if ul-FullPowerTransmission in PUSCH-Config is set to fullpowerMode1, and each SRS resource in the SRS-ResourceSet with usage set to 'codebook' has more than one SRS port', is the ratio of a number of antenna ports with non-zero PUSCH transmission power over the maximum number of SRS ports supported by the UE in one SRS resource

-     if ULFPTxModes in PUSCH-Config is set to fullpowerMode2, for full power TPMIs reported by the UE [16, TS 38.306], and is the ratio of a number of antenna ports with non-zero PUSCH transmission power over a number of SRS ports for remaining TPMIs, where the number of SRS ports is associated with a SRS resource indicated by SRI if more than one SRS resources are configured in the SRS-ResourceSet with usage set to 'codebook', or the number of SRS ports is associated with the SRS resource if only one SRS resource is configured in the SRS-ResourceSet with usage set to 'codebook', and

-     if ULFPTxModes in PUSCH-Config is set to fullpower,

-    else, if each SRS resource in the SRS-ResourceSet with usage set to 'codebook' has more than one SRS port, the UE scales the linear value by the ratio of the number of antenna ports with a non-zero PUSCH transmission power to the maximum number of SRS ports supported by the UE in one SRS resource.

The UE splits the power equally across the antenna ports on which the UE transmits the PUSCH with non-zero power.

-------------------------------------------

1. Given the above analysis we propose to keep the three modes for ULFPTX

**Q2: Companies are asked give their views on Proposal 2 on whether they think it could be agreed over email or whether it should be discussed online taking into account the chairman’s guidance as below:**

* + - Set of proposals with full consensus (aim to agree to those over email)
    - Set of proposals that need further (online) discussion

|  |  |  |
| --- | --- | --- |
| Company | Online/email | Comments on Proposal 2 |
| Samsung | Email | Support the proposal, it seems capture RAN1 intention better. |
| Ericsson | Email |  |
| Nokia | Email | We agree the above seems clearer than existing one. |
| Qualcomm | Email or online | Since it is indicated from the Note 1 that whether ULFPTx and ULFPTxModes can be merged is up to RAN2 to decide, it is RAN2 work to propose the detailed value, i.e. 3-mode structure.  But if the proposal has RAN1 spec impact, we would to suggest sending LS to RAN1 to check whether there are issues on 3-mode structure from RAN1 perspective. |
| Intel | *Email* | *We are ok with the proposal.* |
| Huawei | Email | Proposal is ok but with two parameters would be equally ok |
|  |  |  |

#### M-TRP

Based on internal RAN1 feedback parameter BDFactor does not seem appropriate to configure this per serving cell. Proposal, as implemented in running CR, is to place this under PhysicalCellGroupConfig where ackNackFeedBackMode is also configured.

1. Agree the BDFactor to be placed under PhysicalCellGroupConfig with ENUMERATED {n1}.

**Q3: Companies are asked give their views on Proposal 3 on whether they think it could be agreed over email or whether it should be discussed online taking into account the chairman’s guidance as below:**

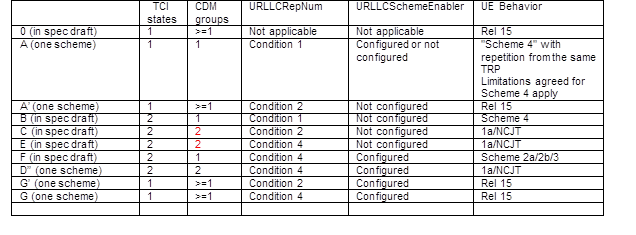
* + - Set of proposals with full consensus (aim to agree to those over email)
    - Set of proposals that need further (online) discussion

|  |  |  |
| --- | --- | --- |
| Company | Online/email | Comments on Proposal 3 |
| Samsung | Email or online | Not sure for the above explain about RAN1 feedback. From our RAN1 input, NC-JT operation can be turn on and off per cell. Therefore, BDFactor per cell is appropriate than per cell group. |
| Nokia | Either | The PhysicalCellGroupConfig is per cell group, so the parameters would be for all cells in the CG. Hence, we agree with Samsung that this seems like a reason to keep the bdFactor as per-cell parameter (since that was also our understanding of RAN1 intent). |
| Qualcomm | Email | Agree |
| Intel | Email | Agree that BDFactor per cell is appropriate |
| Huawei | Online or email | BDFactor should be per cell |
|  |  |  |

A repetition scheme related table from RAN1 is as follows:

Agreement

Following TCI state and joint schemes are supported



Note:

1. Condition 1: indicates ~~at least~~ one entry inpdsch-TimeDomainAllocationList containing URLLCRepNum (>1) in TDRA by DCI
2. Condition 2: indicates one entry inpdsch-TimeDomainAllocationList having noURLLCRepNum by DCI, but at least one entry having URLLCRepNum
3. Condition 4: None of entry in TDRA containsURLLCRepNum

It is true that scheme 4 and schemes 2a/2b/3 are mutually exclusive according to the RAN1 agreed table below (rows B and F). However, according to row 0/A/G/G’ of the RAN1 agreed table, scheme 4 and schemes 2a/2b/3 could both be configured in RRC if only 1 TCI state ( or single TRP) is to be indicated. In this case, the configuration would be ignored if 1 TCI state and >1 CDM group are configured according to row 0/G/G’, or scheme 2a/2b/3 is ignored if 1 TCI state and 1 CDM group are configured according to row A, and neither scheme 4 nor scheme 2a/2b/3 would work if two TCI states (2 TRPs) are indicated according to Rows B/F.

Our proposal is to have own IE for repetition scheme configuration as implemented in current running CR and copied here for convenience. It allows to configure scheme 4 with one of schemes 2a/2b/3 and leaves further restrictions up to RAN1 specification. We further propose to move the configuration of repetition schemes from BPW-DownlinkDedicated to PDCCH-Config. Note that this is not currently implemented in running CR.

#### – *RepetitionSchemeConfig*

The IE *RepetitionSchemeConfig* is used to configure the UE with repetition schemes as specified in TS 38.214.

*RepetitionSchemeConfig* information element

RepetitionSchemeConfig-r16 ::=       SEQUENCE  {

fdm-tdm                     SetupRelease   { FDM-TDM } OPTIONAL, –- Need R

slotBased                   SetupRelease   { SlotBased }   OPTIONAL –- Need R

}

FDM-TDM ::= SEQUENCE {

repetitionScheme-r16            ENUMERATED {fdmSchemeA, fdmSchemeB,tdmSchemeA },

startingSymbolOffsetK-r16       INTEGER (0..7)       OPTIONAL –- Need R

}

SlotBased ::= SEQUENCE {

    tciMapping-r16                   ENUMERATED {cyclicMapping, SequenticalMapping},

    sequenceOffsetforRV-r16          INTEGER (1..3)

}

|  |
| --- |
| *RepetitionSchemeConfig* field descriptions |
| ***tdm-fdm***  Configures UE with a repetition scheme scheme among fdmSchemeA, fdmSchemeB and tdmSchemeA as specified in clause 5.1 of TS 38.214 |
| ***sequenceOffsetforRV***  For slot-based repetition scheme, selected RV sequence is applied to transmission occasions associated to the first TRP (i.e. the first TCI state). The RV sequence associated to the second TRP (i.e. the second TCI state) is determined by a RV offset from that selected RV sequence. |
| ***slotBased***  Configures UE with slot based repetition scheme. When slot based repetition scheme is configured the parameter *repetitionNumber* is present in IE *PDSCH-TimeDomainResourceAllocationList* |
| ***startingSymbolOffsetK***  The starting symbol of the second transmission occasion has K symbol offset relative to the last symbol of the first transmission occasion. When UE is configured with *tdmSchemeA,* the parameter *startingSymbolOffsetK* is present, otherwise absent. |
| ***tciMapping***  Enables TCI state mapping method to PDSCH transmission occasions. |

1. Agree the existing RepetitionSchemeConfig IE in the running CR as baseline for repetition scheme configuration.

**Q4: Companies are asked give their views on Proposal 4 on whether they think it could be agreed over email or whether it should be discussed online taking into account the chairman’s guidance as below:**

* + - Set of proposals with full consensus (aim to agree to those over email)
    - Set of proposals that need further (online) discussion

|  |  |  |
| --- | --- | --- |
| Company | Online/email | Comments on Proposal 4 |
| Samsung | Online | We agree that this signaling is working properly but it may require some changes in RAN1 specification.  We believe there are some other signaling options but no strong view on this, maybe we can support this.  However, it seems better to change the SEQUENCE structure for RepetitionSchemeConfig-r16 to CHOICE structure because fdm-tdm and slotBased should not be configured simultaneously.  If we stick to use SEQUECE structure here, some restriction/condition is required. |
| Ericsson | online | SEQUENCE and then reference to RAN1 specification should be enough for restrictions. |
| Nokia | Either | We understood that the slot-based scheme is actually activated by the parameter in PDSCH-TimeDomainAllocation, and the inclusion of RepetitionSchemeConfig is contingent on that. Hence, the current field descriptions is slotBased is not fully correct. |
| Qualcomm | Online | There is a typo on fdm-tdm that does not consist with the field description tdm-fdm.  Suggest using CHOICE structure. |
| Huawei | Online | We agree with Samsung that fdm-tdm and slotBased are mutually exclusive. |
|  |  |  |

1. Move the configuration of repetition schemes from BPW-DownlinkDedicated to PDCCH-Config i.e. implement this change in running RRC CR.

**Q5: Companies are asked give their views on Proposal 5 on whether they think it could be agreed over email or whether it should be discussed online taking into account the chairman’s guidance as below:**

* + - Set of proposals with full consensus (aim to agree to those over email)
    - Set of proposals that need further (online) discussion

|  |  |  |
| --- | --- | --- |
| Company | Online/email | Comments on Proposal 5 |
| Samsung | Online | We don’t think the current configuration has problem, so no changes are required. |
| Nokia | Either | No strong opinion but is there some issue is keeping the configurations in BWP-DownlinkDedicated? |
| Qualcomm | Online | It is unclear for us why should move the configuration to PDCCH-config |
| Huawei | Online or email | The definition of *RepetitionSchemeConfig* refers to 38.214 CR, in which it is used for PDSCH reception, then wouldn't the most logical place be *PDSCH-Config*? |
|  |  |  |
|  |  |  |

The value range for coresetPoolIndex-r16 in ControlResourceSet should be discussed. Currently has INTEGER (1..1).

1. Discuss and agree the value range for coresetPoolIndex-r16 in ControlResourceSet.

**Q6: Companies are asked give their views on Proposal 6 on whether they think it could be agreed over email or whether it should be discussed online taking into account the chairman’s guidance as below:**

* + - Set of proposals with full consensus (aim to agree to those over email)
    - Set of proposals that need further (online) discussion

|  |  |  |
| --- | --- | --- |
| Company | Online/email | Comments on Proposal 6 |
| Samsung | Email | No strong view, it seems fine. |
| Nokia | Either | We prefer to use INTEGER(0..1) to allow explicit configuration of the index 0 as well. It seems strange to omit that, even if the rules on absence is needed for legacy compatibility. |
| Qualcomm | Email |  |
| Huawei | Email | It is fine. |
|  |  |  |
|  |  |  |

#### MB1+2

The suggested conclusion for the RSRP threshold for selecting candidate beam to be indicated in the MAC CE we propose to agree the current RRC running CR implementation i.e. have only rsrp-ThresholdSSBBFR which is used for beam selection for MAC CE and rename rsrp-ThresholdSSBBFR to rsrp-ThresholdBFR.

1. Agree the current RRC running CR implementation i.e. have only rsrp-ThresholdSSBBFR which is used for beam selection for MAC CE and rename rsrp-ThresholdSSBBFR to rsrp-ThresholdBFR. (MAC CR needs to be aligned)

**Q7: Companies are asked give their views on Proposal 7 on whether they think it could be agreed over email or whether it should be discussed online taking into account the chairman’s guidance as below:**

* + - Set of proposals with full consensus (aim to agree to those over email)
    - Set of proposals that need further (online) discussion

|  |  |  |
| --- | --- | --- |
| Company | Online/email | Comments on Proposal 7 |
| Samsung | Email | No strong view on the naming, seems fine. |
| Ericsson | Email |  |
| Nokia | Either | We are fine with current naming. |
| Intel | Either | No strong view |
| Huawei | Email | No strong view on the naming, seems fine. |
| ZTE | Either | rsrp-ThresholdBFR is fine to us. |

Discussion for max number of detection resources should be concluded. The restriction of 2 per BWP is in field description of parameter failureDetectionResourcesToAddModList in IE radiolinkMonitoringConfig. For the parameter radiolinkMonitoringConfig in IE BWP-DownlinkDedicated, add Release 16 in addition to existing Release 15 as shown below:

***radioLinkMonitoringConfig***

UE specific configuration of radio link monitoring for detecting cell- and beam radio link failure occasions. The maximum number of failure detection resources should be limited up to 8 for both cell and beam radio link failure detection in Rel-15 and Rel-16. For SCells, the purpose field is set to beamFailure and only periodic 1-port CSI-RS can be configured in IE *RadioLinkMonitoringConfig*.

1. Agree the current RRC running CR implementation for max number of detection resource limitation as show above.

**Q8: Companies are asked give their views on Proposal 8 on whether they think it could be agreed over email or whether it should be discussed online taking into account the chairman’s guidance as below:**

* + - Set of proposals with full consensus (aim to agree to those over email)
    - Set of proposals that need further (online) discussion

|  |  |  |
| --- | --- | --- |
| Company | Online/email | Comments on Proposal 8 |
| Samsung | Email | Seems fine. But it seems the same restrictions are also mentioned in detectionResource.  It is better to remove the duplicate description, so just below changes are enough.  ***radioLinkMonitoringConfig***  UE specific configuration of radio link monitoring for detecting cell- and beam radio link failure occasions. The maximum number of failure detection resources should be limited up to 8 for both cell and beam radio link failure detection in Rel-15 and Rel-16. For SCells, the purpose field is set to beamFailure. |
| Ericsson | email |  |
| Nokia | Either | Two points:   * We shouldn’t keep on piling releases in field descriptions, i.e. ”Rel-15 and Rel-16”. unless there is a clear reason to do so. Better just remove both. * The restriction on *purpose* should rather be in the RadioLinkMonitoringConfig field description since the field is defined here. |
| Qualcomm | Email |  |
| Intel | *Email* |  |
| Huawei | Email | This looks fine. |
| ZTE | Email |  |

Further discuss if the parameters enableDefaultBeamPlForPUSCH0\_0, enableDefaultBeamPlForPUCCH, enableDefaultBeamPlForSRS, and PLRS-update parameter are needed. For enableDefaultBeamPlForPUSCH0\_0, enableDefaultBeamPlForPUCCH, enableDefaultBeamPlForSRS: When any of these three is true, the spatial relation and the corresponding pathloss reference Rs is derived from specific DL RS, related to a certain CORESET. If they are disabled, the NW has to configure spatial relation/pathloss reference RS explicitly. Are these needed either? (the absence of an explicit configuration could be sufficient).

1. Discuss if the parameters enableDefaultBeamPlForPUSCH0\_0, enableDefaultBeamPlForPUCCH, enableDefaultBeamPlForSRS, and PLRS-update parameter are needed.

**Q9: Companies are asked give their views on Proposal 9 on whether they think it could be agreed over email or whether it should be discussed online taking into account the chairman’s guidance as below:**

* + - Set of proposals with full consensus (aim to agree to those over email)
    - Set of proposals that need further (online) discussion

|  |  |  |
| --- | --- | --- |
| Company | Online/email | Comments on Proposal 9 |
| Samsung | Online | Let’s see the MAC CE discussion, but we don’t think this indication is needed. |
| Ericsson | Online |  |
| Nokia | Either | No strong view but they were requested, so RAN2 would need to indicate removal to RAN1 and explain why. |
| Qualcomm | Online | They are needed given the RAN1 requirements. Those parameters indicate whether it enables the feature of default spatial relation and PL RS behaviors or not.  If there are anything unclear, we can send LS to RAN1 for clarification.  **Agreement**  Support default spatial relation and default pathloss RS of PUSCH scheduled by DCI format 0\_0 when there is no PUCCH resources configured on the active UL BWP CC in FR2 and in RRC-connected mode, for UEs supporting the feature of the default spatial relation for dedicated-PUSCH in Rel-16   * The default spatial relation is the TCI state / QCL assumption of the CORESET with the lowest ID. * The default pathloss RS is the QCL-TypeD RS of the same TCI state / QCL assumption of the CORESET with the lowest ID   + Note: The PL RS should be periodic RS.   **Agreement (RRC impact)**  For enabling the agreed UE behaviors in Rel-16 on the default spatial relation and pathloss RS,   * Introduce three new RRC parameters to enable the default spatial relation and PL RS behaviors, i.e.,   + enableDefaultBeamPlForPUSCH0\_0, for PUSCH scheduled by DCI format 0\_0   + enableDefaultBeamPlForPUCCH, for dedicated PUCCH   + enableDefaultBeamPlForSRS, for dedicated SRS |
| Huawei | Online | In any case, this should not be coupled with any MAC CE discussion only, this needs detailed understanding of RAN1 specification. Companies proposing this should provide detailed enough explanations and it cannot be decided quickly |
|  |  |  |

For list extension and ID space discussions we are bit hesitant if progress is possible during the e-meeting. If this is attempted, a separate discussion/email could be beneficial.

**Q10: Companies are asked review the RRC CR email discussion WF document R2-2001104** **give their views if any of the aspects captured in current RRC CR but not lifted here ARE NOT OK to be agreed as baseline for ASN1 review. New open issues should be indicated here as well.**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Open issue name | Online/email | Comments on Question 10 |
| Huawei | Configuration of 2nd PDSCH scrambling ID | Email | Should capture that *dataScramblingIdentityPDSCH2* can only be configured if *PDCCH-Config* in the same *BWP-DownlinkDedicated* includes at least one *ControlResourceSet* configured with *coresetPoolIndex* (could also capture that it is deleted by the UE if this is no more the case). |
| Huawei | Need code for SetupRelease | Online | There are several structures with Need R for SetupRelease, we do not understand how this can work |
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# 4 Conclusions

Based on companies replies to first set of agreements seems to have consensus for email approval/with short online view:

**Proposal 2 Given the above analysis we propose to keep the three modes for ULFPTX**

Note: further proposal to inform RAN1 with LS

**Proposal 3 Agree the BDFactor to be placed under PhysicalCellGroupConfig with ENUMERATED {n1}.**

**Proposal 7 Agree the current RRC running CR implementation i.e. have only rsrp-ThresholdSSBBFR which is used for beam selection for MAC CE and rename rsrp-ThresholdSSBBFR to rsrp-ThresholdBFR. (MAC CR needs to be aligned)**

**Proposal 8 Agree the current RRC running CR implementation for max number of detection resource limitation as show above.**

Note: There were comments on fine tuning the restriction. This could be done over email with after above agreement.

Based on input, these proposals could benefit from online discussion:

**Proposal 1 Agree to implement two LTE CRS pattern lists corresponding to each CORESETPoolIndex as indicated in above changes and merge the changes to the running RRC CR for NR eMIMO**

Discussion: up to 6 CRS patterns in two lists or one list. If two list how to extend in future, if one list how to implement overlapping/non-overlapping restrictions.

**Proposal 3 Agree the BDFactor to be placed under PhysicalCellGroupConfig with ENUMERATED {n1}.**

Discussion: BDFactor is per cell or per cellgroup?

**Proposal 4 Agree the existing RepetitionSchemeConfig IE in the running CR as baseline for repetition scheme configuration.**

Discussion: How to interpret RAN1 intention on if fdm-tdm and slotBased are mutually exclusive always or not. Further, how to implement configuration restrictions that is, in code or in field descriptions.

**Proposal 5 Move the configuration of repetition schemes from BPW-DownlinkDedicated to PDCCH-Config i.e. implement this change in running RRC CR.**

**Proposal 6 Discuss and agree the value range for coresetPoolIndex-r16 in ControlResourceSet.**

Discussion: If we explicitly configure INTEGER(0..1) do we need restriction that if 0 is configured 1 has to be configured as well in addition to rules on absence for legacy compatibility?

**Proposal 9 Discuss if the parameters enableDefaultBeamPlForPUSCH0\_0, enableDefaultBeamPlForPUCCH, enableDefaultBeamPlForSRS, and PLRS-update parameter are needed.**

**From Question 10:**

**Issue1:**

Should capture that *dataScramblingIdentityPDSCH2* can only be configured if *PDCCH-Config* in the same *BWP-DownlinkDedicated* includes at least one *ControlResourceSet* configured with *coresetPoolIndex* (could also capture that it is deleted by the UE if this is no more the case).

**Issue2:**

There are several structures with Need R for SetupRelease, we do not understand how this can work

# 5 References

1. R2-2000860, Multiple rate matching patterns with M-TRP Nokia, Nokia Shanghai Bell, RAN2#109-e, Electronic Meeting, February 2020
2. R2-2001036, Discussion the MIMO RRC parameter CRS pattern list Qualcomm Incorporated, RAN2#109-e, Electronic Meeting, February 2020
3. R2-2001104, Proposals for [108#36][NR eMIMO] Running RRC CR (Ericsson) Ericsson Limited, RAN2#109-e, Electronic Meeting, February 2020
4. R2-2001109, Running RRC CR for Introduction of NR eMIMO Ericsson, RAN2#109-e, Electronic Meeting, February 2020
5. R2-2001345, Remaining RRC signalling aspects of NR eMIMO Intel Corporation, RAN2#109-e, Electronic Meeting, February 2020