3GPP TSG-RAN WG2 Meeting #117 Electronic R2-2203753

Elbonia, February 2022

**Agenda item: 8.17.3.1**

**Source: Ericsson**

**Title: [AT117-e][009][feMIMO] RRC 1 (Ericsson)**

**WID/SID: feMIMO\_solutions\_Core**

**Document for: Discussion and Decision**

# Introduction

* [AT117-e][009][feMIMO] RRC 1 (Ericsson)

 Scope: Take into account on-line. Make further progress based on non-resolved parts of R2-2203050 if any. Progress P10 and P14 from R2-2203719. Take into account new LS from RAN1 when/if it becomes available, to the extent reasonable. Update RRC CR. (this discussion will also continue as a post discussion for the CR). Determine agreeable parts, identify discussion points if any.

 Intended outcome: Report, revised RRC CR (CR might not be needed for CB).

 Deadline: In time for online CB W2 Wednesday

Second part of the discussion added to treat reply LS [1] See Section 4. If a question is not treated here it was either deduced very straightforward to be implemented or not RRC CR specific.

DL to provide input is Wed 2nd March 10:00 UTC.

[1] R2-2203893         LS on feMIMO RRC parameters (R1-2202720; contact: Ericsson)

# 2 Contact Points

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

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| Ericsson | Helka-Liina Määttänen | Helka-liina.maattanen@ericsson.com |
| Vivo | Chenli | Chenli5g@vivo.com |
| Huawei, HiSilicon | David Lecompte | david.lecompte@huawei.com |
| CATT | Erlin Zeng | erlin.zeng@catt.cn |
| Samsung | Seungri Jin | seungri.jin@samsung.com |
| Intel | Youn Heo | Youn.hyoung.heo@intel.com |
| LGE | SungHoon Jung | Sunghoon.jung@lge.com |
| OPPO | ZhongdaDu | duzhongda@oppo.com |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

# 3 Discussion

3.1 Reuse of Rel-15 TCI state Id space for unified DLorJoint id space

Progress P10 from R2-2203719

|  |  |
| --- | --- |
| Tdocs | Proposals  |
| R2-2203041  | 1. RAN2 discuss whether existing TCI state ID space should be reused for unified TCI state for joint/DL TCI state.
 |

In the current CR, DLorJoint-TCIState-Id-r17 is introduced but it is also possible to TCI-StateId for the DLorJoint-TCIState-r17 IE.

**Proposal 10: RAN2 discuss whether existing TCI state ID space should be reused for unified TCI state for joint/DL TCI state.**

 [1] R2-2203041 FeMIMO RRC impact Ericsson discussion Rel-17 NR\_feMIMO-Core

Current RRC implements two new ID spaces DLorJoint-TCIState-Id-r17 and UL-TCIState-Id-r17:

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

DLorJoint-TCIState-Id-r17 ::= INTEGER (0..max-DLorJointTCI-r17-1)

UL-TCIState-Id-r17 ::= INTEGER (0..max-UL-TCI-r17-1)

However, the ID space for DLorJoint-TCIState-Id-r17 is exactly same as for TCI-StateId. Thus it is suggested to reuse TCI-StateId for the DLorJoint-TCIState-r17 IE.

This would also mean that the below rows of excel would not be needed. These are implemented now in the running RRC CR as per conclusions of RAN2#117 but this could be reverted.

|  |  |  |
| --- | --- | --- |
| Parameter name in the spec | Description | Comment |
| CSI-AssociatedReportConfigInfo | QCL info for aperiodic CSI-RS. | Replace TCI-StateId with TCI-StatedId\_r17. Not needed if TCI-StateId is reused.Applies only to Rel-17 unified TCI Framework |
| NZP-CSI-RS-Resource | QCL info for periodic CSI-RS | Replace TCI-StateId with TCI-StatedId\_r17. Not needed if TCI-StateId is reused.Applies only to Rel-17 unified TCI Framework |

It can of course be discussed which is nicer, to have the new ID space for clarity or to reuse the existing ID space. Options are:

Option 1 Release-15 *TCI-StateId* is reused for *DLorJoint-TCIState-Id-r17* and update RRC CR accordingly.

Option 2 Keep existing RRC CR implementation with *DLorJoint-TCIState-Id-r17*

**Q1: Please indicate which option you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comments |
| Ericsson | Option 1 |  |
| Intel | Option 1 |  |
| Vivo | Option 1 |  |
| Huawei, HiSilicon | Option 1 |  |
| CATT | Option 1 | Option 1 is ok if common understanding is that the maximum # of TCI states (i.e., 128) includes both all TRPs.  |
| Samsung | Option 1 |  |
| OPPO | Option 1 |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Conclusion Q1**

TBA

3.2 BFD/BFR RRC configuration

Make further progress based on non-resolved parts of R2-2203050 if any. There is one non-resolved point that does not pend on RAN1 LS:

**Conclusion Q5[SIC!]**

There is consensus for proposal 3. However, seems BeamFailureRecoverySCellConfig is per DL BWP but BeamFailureRecoveryConfig is per UL BWP! Thus the suggestion would be straightforward for SCell but not for PCell. While there was support for the original proposal, we should discuss this more.

**Proposal 3[SIC!] RAN2 to discuss whether to add candidateBeamresourceList2 in IE BeamFailureRecoverySCellConfig and both candidateBeamresourceList and candidateBeamresourceList2 in IE BeamFailureRecoveryConfig. FFS configure BeamFailureRecoveryConfig in DL BWP or configure only candidateBeamresourceList and candidateBeamresourceList2 for PCell for DL-BWP.**

The rows 62 and 63 are about candidate beam resource configurations:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| candidateBeamResourceList[1] | resource list (including periodic CSI-RS resource configuration indexes and/or SS/PBCH block indexes) for M-TRP new beam identification set 1 | sequence (size of (1,…,maxNrofCandidateBeams)) of candidateBeamRS | Per DL BWPin BeamFailureRecoveryConfig or BeamFailureRecoveryMTRPConfig | NOTE: FFS if this parameter is needed in Rel.17 M-TRP BFR. That is, whether Rel.17 M-TRP BFR should reuse candidateBeamResourceList (Rel.16 parameter), or introduce a new parameter candidateBeamResourceList1. Agreement: To associate BFD-RS set k and NBI-RS set j· Alt-1: 1-to-1, fixed in spec· Whether NBI-RS configuration is mandatory is separate discussion |
| candidateBeamResourceList2 | resource list (including periodic CSI-RS resource configuration indexes and/or SS/PBCH block indexes) for M-TRP new beam identification set 2 | sequence (size of (1,…,maxNrofCandidateBeams)) of candidateBeamRS | Per DL BWPin BeamFailureRecoveryConfig or BeamFailureRecoveryMTRPConfig | Agreement: To associate BFD-RS set k and NBI-RS set j· Alt-1: 1-to-1, fixed in spec· Whether NBI-RS configuration is mandatory is separate discussion |

As beamfailure recovery works differently for PCell and Scells, RRC has two IEs for respective configurations: *BeamFailureRecoveryConfig BeamFailureRecoverySCellConfig.* The per TRP recovery is SR based like BFR for SCells, the SCell configuration can reuse the Rel-16 recovery resource configuration for one TRP thus only one candidateBeamresourceList needs to be added. Also BeamFailureRecoverySCellConfig is per DL BWP so it should work.

However, seems but BeamFailureRecoveryConfig is per UL BWP! Thus the suggestion that is straightforward for SCell is not for PCell.

Options are

Option 1 add *candidateBeamresourceList2* in IE *BeamFailureRecoverySCellConfig* and both *candidateBeamresourceList* and *candidateBeamresourceList2* in IE *BeamFailureRecoveryConfig* and configure *BeamFailureRecoveryConfig* in DL BWP

Option 2 add *candidateBeamresourceList2* in IE *BeamFailureRecoverySCellConfig* and add *candidateBeamresourceList* and *candidateBeamresourceList2* for PCell for *BWP-DownlinkDedicated*.

Option 3 Other

**Q2: Please indicate which option is preferred**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comments |
| Ericsson | 2 |  |
| Intel | 2 | If we go with option 1, *BeamFailureRecoveryConfig* is moved from UL BWP to DL BWP. It seems a strange option.  |
| vivo | Option 3? | Add *candidateBeamresourceList2* in IE *BeamFailureRecoverySCellConfig* and both *candidateBeamresourceList* and *candidateBeamresourceList2* in IE *BeamFailureRecoveryConfig* and configure *BeamFailureRecoveryConfig* in BWP-DownlinkDedicated |
| Huawei, HiSilicon |  | To provide the necessary parameters, the smallest changes to 38.331 would be to add candidateBeamResourceList2 in BeamFailureRecoveryConfigSCell and use BeamFailureRecoveryConfigSCell also for the SpCell.Of course, it is then a little strange that this has the name "SCell" but perhaps there could be some renaming.However, we also need to clarify whether the SpCell can be configured with BeamFailureRecoveryConfig and with (*candidateBeamresourceList* + *candidateBeamresourceList2).* BeamFailureRecoveryConfig supports CFRA while (*candidateBeamresourceList* + *candidateBeamresourceList2)* has no resources for CFRA.  |
| CATT | see comments | Huawei has a point that Spcell and Scell may use the same IE, which then include *candidateBeamresourceList* and *candidateBeamresourceList2.* One possible way is not to extend *BeamFailureRecoverySCellConfig,* but we define a new IE *BeamFailureRecoveryServingCellConfig,* so that both Spcell and Scell can refer to this new IE, if two BFD sets are configured. Then regarding Huawei’s comment on BeamFailureRecoveryConfig, we think it is good to clarify. And in our understanding, R1 didn’t agree to support CFRA when two BFD sets are configured for Spcell. So to make it simple, we’d suggestion R2’s confirmation that no need to consider Spcell being configured with BeamFailureRecoveryConfig together and with (*candidateBeamresourceList* + *candidateBeamresourceList2)* |
| Samsung | Option 2 | It seems simple. |
| OPPO | Option 2 | We prefer to put the similar parameter together for PCell also. Even *BeamFailureRecoveryConfig* is in UL BWP, but considering BFR MAC CE can be also contained within RAR, it should be also fine. In addition this approach should be applicable for SpCell instead of PCell only. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Conclusion Q2**

TBA

3.3 ASN1 corrections

Progress P14 from R2-2203719:

|  |  |
| --- | --- |
| Tdocs | Proposals  |
| R2-2202447 [4] | Proposal 2: configure csi-SSB-ResourceSet-r17 within resourcesForChannel2-r17 as CSI-SSB-ResourceSetId |

Since csi-SSB-ResourceSet-r17 cannot be indicated other than 1, it should be updated.

csi-SSB-ResourceSet-r17 INTEGER (1..maxNrofCSI-SSB-ResourceSetsPerConfig

It seems valid point because csi-SSB-ResourceSet-r17 is configured with “1” only which is the same as Rel-15 csi-SSB-ResourceSet.

**Proposal 14[SIC!]: RAN2 discuss whether to configure csi-SSB-ResourceSet-r17 within resourcesForChannel2-r17 as CSI-SSB-ResourceSetId (i.e. instead of INTEGER (1..maxNrofCSI-SSB-ResourceSetsPerConfig).**

[4] **[SIC!]** R2-2202447 Discussion on FeMIMO open issues OPPO discussion Rel-17 NR\_feMIMO-Core

This is about configuring resources for AP CSI-RS for mTRP operation for the second TRP. The excel gives row 58 as

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| resourcesForChannel2 | CMR resource set 2 associated to CSI-AssociatedReportConfigInfo  | Same as Rel.16 resourcesForChannel | per CSI-AssociatedReprotConfigInfoin CSI-AssociatedReprotConfigInfo | CMR resource set 1 corrsponds to Rel.16 parameter resourcesForChannel |

The RRC CR has implemented the resourceForChannel2 by duplicating the original resourceForChannel. As the within original code, also the new code points to csi-SSB-ResourceSet-r17 as index of a list csi-SSB-ResourceSetList .

– *CSI-AperiodicTriggerStateList*

The *CSI-AperiodicTriggerStateList* IE is used to configure the UE with a list of aperiodic trigger states. Each codepoint of the DCI field "CSI request" is associated with one trigger state (see TS 38.321 [3], clause 6.1.3.13). Upon reception of the value associated with a trigger state, the UE will perform measurement of CSI-RS, CSI-IM and/or SSB (reference signals) and aperiodic reporting on L1 according to all entries in the *associatedReportConfigInfoList* for that trigger state.

***CSI-AperiodicTriggerStateList* information element**

-- ASN1START

-- TAG-CSI-APERIODICTRIGGERSTATELIST-START

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

CSI-AperiodicTriggerState ::= SEQUENCE {

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

 ...

}

CSI-AssociatedReportConfigInfo ::= SEQUENCE {

 reportConfigId CSI-ReportConfigId,

 resourcesForChannel CHOICE {

 nzp-CSI-RS SEQUENCE {

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

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

 OPTIONAL -- Cond Aperiodic

 },

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

 },

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

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

 ... ,

 [[

 followUnifiedTCIstate-r17 ENUMERATED {enabled} OPTIONAL, -- Need R

 -- Editor’s note: OPTION 2: at CSI hypothesis level, which means each CSI hypothesis can separately be configuredd

 -- Editor’s note: this applies only to CMR

 -- Editor’s note: FFS on further input if this is the correct placement

 qcl-infoUnifiedTCIstate-r17 SEQUENCE (SIZE(1..maxNrofAP-CSI-RS-ResourcesPerSet)) OF DLorJoint-TCIState-Id-r17

-- Editor’s note: If this is configured UE ignores qcl-info

-- Editor’s note: Not needed if id space of Rel15/16 TCI state is reused.

 ap-CSI-MultiplexingMode-r17 ENUMERATED {enabled} OPTIONAL, -- Need R

 resourcesForChannel2-r17 CHOICE {

 nzp-CSI-RS2-r17 SEQUENCE {

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

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

 OPTIONAL -- Cond Aperiodic

 },

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

 } OPTIONAL -- Need R

 ]]

}

-- TAG-CSI-APERIODICTRIGGERSTATELIST-STOP

-- ASN1STOP

***csi-SSB-ResourceSet***

CSI-SSB-ResourceSet for channel measurements. Entry number in *csi-SSB-ResourceSetList* in the *CSI-ResourceConfig* indicated by *resourcesForChannelMeasurement* in the *CSI-ReportConfig* indicated by *reportConfigId* above (value 1 corresponds to the first entry, value 2 to the second entry, and so on).

– *CSI-ResourceConfig*

The IE *CSI-ResourceConfig* defines a group of one or more *NZP-CSI-RS-ResourceSet*, *CSI-IM-ResourceSet* and/or *CSI-SSB-ResourceSet*.

***CSI-ResourceConfig* information element**

-- ASN1START

-- TAG-CSI-RESOURCECONFIG-START

CSI-ResourceConfig ::= SEQUENCE {

 csi-ResourceConfigId CSI-ResourceConfigId,

 csi-RS-ResourceSetList CHOICE {

 nzp-CSI-RS-SSB SEQUENCE {

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

 OPTIONAL, -- Need R

 csi-SSB-ResourceSetList SEQUENCE (SIZE (1..maxNrofCSI-SSB-ResourceSetsPerConfig)) OF CSI-SSB-ResourceSetId OPTIONAL -- Need R

 },

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

 },

 bwp-Id BWP-Id,

 resourceType ENUMERATED { aperiodic, semiPersistent, periodic },

 ...,

 [[

 csi-SSB-ResourceSet2-r17 CSI-SSB-ResourceSetId-r17 OPTIONAL -- Need R

 ]]

}

-- TAG-CSI-RESOURCECONFIG-STOP

-- ASN1STOP

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

This list is implemented as SEQUENCE that is limited to size 1. Suggestion in R2-2202447 is to give the CSI-SSB-ResourceSetId directly. If we make the change, the field description of csi-SSB-ResourceSet cannot be used for csi-SSB-ResourceSet2.

Options are

Option 1 Configure *csi-SSB-ResourceSet2-r17* within *resourcesForChannel2-r17* as *CSI-SSB-ResourceSetId* (i.e. instead of INTEGER (1..*maxNrofCSI-SSB-ResourceSetsPerConfig*).

Option 2 Keep existing RRC CR implementation for *resourcesForChannel2-r17*

 **Option 3: The existing RRC CR implementation but:**

 **- csi-SSB-ResourceSet2 should be an INTEGER (1..2)**

**- - a new field csi-SSB-ResourceSetExt is added which is INTEGER (1..2)**

**- - in CSI-ResourceConfig, csi-SSB-ResourceSet2-r17 should be called csi-SSB-ResourceSetListExt-r17, i.e. it is one more element to the existing list**

**Q3: Please indicate which option you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comments |
| Ericsson | Option 2 | No strong preference though |
| Intel | FFS | Need to check with RAN1. What RAN1 indicated is to change “Maximum number of CSI-SSB-Resouce set per CSI-ResourceConfig” by changing ‘maxNrofCSI-SSB-ResourceSetsPerConfig’ to 2. In addition, RAN1 requested two CMR resource by introducing additional “resourcesForChannel2”. It is not clear whether “maxNrofCSI-SSB-ResourceSetsPerConfig” within resourcesForChannel2 should be changed from “maxNrofCSI-SSB-ResourceSetsPerConfig’. Actually, from the legacy signaling, it is not clear why “csi-SSB-ResourceSet INTEGER (1..maxNrofCSI-SSB-ResourceSetsPerConfig)” is introduced given that it indicates only 1 and mandatory field.  |
| Vivo | 1 or 2 | No strong preference. Either is fine.  |
| Huawei, HiSilicon | Option 3 | Option 3 implements what Intel has commented about.Neither option 1 nor option 2 is suitable because there should be a choice between two CSI-SSB-Resource-Set for CMR resources 1 and 2. In addition, option 2 makes the number of CSI-SSB-Resource-Set per CSI-ResourceConfig unlimited, which is against RAN1 agreement. |
| CATT | Option 2 |  |
| Samsung | Option 3 | Keeping the legacy ASN.1 structure with some extension is preferred. Option 3 is working on this principle. |
| OPPO | Option1 or option 3 with comment | First of all, option 2 i.e. current running CR doesn’t work since both csi-SSB-ResourceSet and csi-SSB-ResourceSet2-r17 can only refer to the same one i.e. the legacy one. This makes the addition of csi-SSB-ResourceSet2-r17 in the CSI-ResourceConfig useless.We think option1 can at least resolve this problem and work. Note to put detail CSI-SSB-ResourceSetId instead of an index still mean there is only one set but not unlimited. Option3 is better in the sense csi-SSB-ResourceSet2-r17 in 2nd CMR can refer to either 1st or 2nd set in CSI-ResourceConfig. It is not clear whether the legacy csi-SSB-ResourceSet in 1st CMR is to be replaced by csi-SSB-ResourceSetExt. If yes, this relationship i.e. legacy csi-SSB-ResourceSet in 1st CMR should be ignored should be clarified in the field description of csi-SSB-ResourceSetExt. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Conclusion Q1**

TBA

3.4 RRC CR review

**Please review the CR and bring up other corrections if any**

**Q4: Please indicate further corrections?**

|  |  |  |
| --- | --- | --- |
| Company | IE | Comments |
| Intel |  |  We need to discuss further based on RAN1 LS.  |
| vivo | groupBasedBeamReporting-r17 |  In current RAN1 specification, this parameter is included as below. But this parameter was removed in RRC CR, we prefer to add this parameterTS38.214 5.2.1.4.2if the UE is configured with the higher layer parameter *groupBasedBeamReporting-r17*, the UE is not required to update measurements for more than 64 CSI-RS and/or SSB resources, and the UE shall report in a single reporting instance *nrofReportedRSgroup,* if configured, group(s) of two CRIs or SSBRIs selecting one CSI-RS or SSB from each of the two CSI Resource Sets for the report setting, where CSI-RS and/or SSB resources of each group can be received simultaneously by the UE.[Intel] We agree with vivo’s point.  |
| vivo | CSI-SSB-ResourceSet | According to RAN1 agreement below, each SSB should be associated with a AdditionalPCIindex. We suggest to include addtionalPCIlist-r17 in CSI-SSB-ResourceSet, or include addtionalPCI-r17 in SSB-index.**Agreement**On Rel-17 enhancements for inter-cell beam management and inter-cell mTRP, a CSI-SSB-ResourceSet configured for L1-RSRP measurement/reporting includes at least a set of SSB indices where PCI indices are associated with the set of SSB indices, respectively. The PCI indices refer to PCIs within the set of PCIs configured for inter-cell beam management or inter-cell multi-TRP.* The additionalInfo associated with SSB(s) with PCI(s) different from the serving cell agreed in RAN1 Agenda Item 8.1.2.2 is also applicable to inter-cell BM
* Detailed signaling design is up to RAN2
* FFS (to be concluded in RAN1#107-e): Whether the above L1-RSRP measurement/reporting also includes group-based beam report for inter-cell mTRP

[Intel] This is aligned with RAN1 response in the LS (Q1.13) |
| vivo | *MAC-CellGroupConfig* | We think SR for R16 SCell BFR should be shared with SR for TRP-specific BFR. Hence, we suggest to remove *schedulingRequestID-BFR2-r17.*[Intel] I understand vivo is referring to schedulingRequestID-BFR-SCell-r16. We agree with vivo. In this case, it might be easier to remove schedulingRequestID-BFR-r17 to differentiate i.e. schedulingRequestID-BFR-SCell-r16 and schedulingRequestID-BFR2-r17.   |
| Vivo | *PUCCH-SpatialRelationInfo* | I assume there is no conclusion in RAN1 on whether PUCCH spatial is associated with addiotionalPCI-r17 RAN1. Hence, we suggest to remove this by now to wait for further progress from RAN1.[Intel] We added this question in our LS last week. We could wait but vivo’s understanding is still valid. RAN2 can remove for now. Or wait for RAN1 response.  |
| Huawei, HiSilicon | CSI-SSB-ResourceSet | RAN1 replied the LS in R2-2203893.“it should be possible that different SSB indexes in the same CSI-SSB-ResourceSet are associated with different additionalPCI.”[Intel] Same as above vivo’s comment.  |
| CATT | DLorJoint-TCIState-r17 | As we proposed in R2-2203102, the current running CR implemented the additional PCI within the QCL-Info, however there maybe two QCL type of a TCI-state and it is seems common understanding that the two additional PCI within the QCL-Info within the TCI-state should be the same. From our view, there are two possible options, i.e., 1) some restrictions better to be added in the corresponding field description, or 2) we can add the additional PCI within the DLorJoint-TCIState-r17 (for R17 unified TCI framework) and the TCI-State (for R17 inter-cell mTRP) separately.[Intel] we prefer the first option keeping the current signaling structure.  |
| CATT | SSB-MTCAdditionalPCI-r17 | SSB-MTCAdditionalPCI-r17 ::= SEQUENCE {  additionalPCIIndex-r17 AdditionalPCIIndex-r17,  additionalPCI-r17 PhysCellId,  ssb-periodicity-r17 ENUMERATED { ms5, ms10, ms20, ms40, ms80, ms160, spare2, spare1 } OPTIONAL, -- Need S ssb-ToMeasure-r17 SetupRelease { SSB-ToMeasure } OPTIONAL -- Need M}-- Editor’s note: guidance in excel says SSB periodicity but does not mention offset. Also transmission power is mentioned, this is not added here for now.AdditionalPCIIndex-r17 ::= INTEGER(0..maxNrofAddionalPCI-r17-1)[Intel] agree.  |
| Intel | SSB-MTCAdditionPCI-r17 | RAN1 sent an LS in (R2-2203894)We need to update SSB-MTCAdditionPCI-r17 accordingly. * [The value maxNrofAddionalPCI-r17 is 7.](#_Toc95761913)
* [Change the field name ssb-ToMeasure to ssb-PositionInBurst in SSB-MTCAdditionalPCI-r17.](#_Toc95761914)
* Add the SSB transmission power to SSB-MTCAdditionalPCI-r17

  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Conclusion Q1**

TBA

# 4 LS response

Here the LS response are treated:

**2. MultiBeam related questions**

**CORESET** **to follow Unified TCI state**

RAN2 has discussed the per CORESET RRC based indication based on RAN1 agreements.

* + *For any PDCCH reception on a ‘CORESET B’ and the respective PDSCH reception, whether or not UE to apply the indicated Rel-17 TCI state associated with the serving cell is determined per CORESET by RRC*

RAN2 understands that the 1 bit RRC indication “*followUnifiedTCI-State*” would be needed for CORESET type “B”. RAN2 understanding is that it seems to indicate how the CORESET behaves with respect to the TCI state of PDSCH depending on the type (i.e. CSS or USS) of the SearchSpace that is linked to that CORESET. However, as in RRC there is no types of CORESETs RAN2 would like to ask RAN1 to clarify the intention of the indication in more details.

---\*\*\*---

**Question 1.1:** What is the intent behind this indication and why was it put to CORESET but not per SearchSpace?

**Answer 1.1:**

RAN1 introduced the terms CORESET ‘A’, ‘B’ and ‘C’ for discussion purposes only, and RAN1 has no intention to introduce CORESET types in specification. The 1-bit indication was put in the CORESET to mimic legacy that TCI state is configured and activated (if needed) per CORESET, but not per search space set. RAN1 will describe in RAN1 specifications how the UE should expect/interpret this 1- bit indication.

Note that RAN1 has discussed both options (per CORESET or per SS) for application of indicated Rel-17 TCI state, but it was agreed to support per CORESET indication.

---\*\*\*---

**Question 1.2:** Are there any limitation or conditions needs to specified for the "*followUnifiedTCI-State*" parameter?

**Answer 1.2:**

The limitations or conditions are currently under discussion in RAN1. RAN1 will inform this information to RAN2 as early as possible.

---\*\*\*---

**Question 1.3:** How are the “DM-RS for non-UE dedicated PDCCH” in parameter "*applyTCI-State-DL-List-r17"* and the CORESET B “*followUnifiedTCI-State*” related?

**Answer 1.3**:

Whether or not a CORESET, and consequently the corresponding DM-RS, is configured to follow the unified TCI state is determined by “followUnifiedTCI-State”. The parameter "applyTCI-State-DL-List-r17" is not needed for DM-RS associated with a CORESET.

**Rapporteur comment:** for this parameter below field description is added and editor’s notes are deleted. The field description uses “indicated TCI state” as that is what will be defined in TS 38.214 Clause 5.1.5.

ControlResourceSet ::= SEQUENCE {

 controlResourceSetId ControlResourceSetId,

 frequencyDomainResources BIT STRING (SIZE (45)),

 duration INTEGER (1..maxCoReSetDuration),

 cce-REG-MappingType CHOICE {

 interleaved SEQUENCE {

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

 interleaverSize ENUMERATED {n2, n3, n6},

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

 },

 nonInterleaved NULL

 },

 precoderGranularity ENUMERATED {sameAsREG-bundle, allContiguousRBs},

 tci-StatesPDCCH-ToAddList SEQUENCE(SIZE (1..maxNrofTCI-StatesPDCCH)) OF TCI-StateId OPTIONAL, -- Cond NotSIB1-initialBWP

 tci-StatesPDCCH-ToReleaseList SEQUENCE(SIZE (1..maxNrofTCI-StatesPDCCH)) OF TCI-StateId OPTIONAL, -- Cond NotSIB1-initialBWP

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

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

 ...,

 [[

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

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

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

 controlResourceSetId-v1610 ControlResourceSetId-v1610 OPTIONAL -- Need S

 ]] ,

 [[

 followUnifiedTCIstate-r17 ENUMERATED {enabled} OPTIONAL -- Need R

 ]]

}

***followUnifiedTCIstate***

This parameter indicates whether this CORESET follows the unified TCI state of the “indicated TCI state” as specified in TS 38.214 Clause 5.1.5.

**Q5: Please respond if you think the suggested field description needs to revised already in this meeting? (if you are ok with suggestion no need to respond)**

|  |  |
| --- | --- |
| Company | Suggested revision |
| Intel | It seems ok. One minor addition would be: This parameter indicated whether this CORESET follows the same indicated Rel-17 DLonly/joint TCI state as specified in TS 38.214 Clause 5.1.5. |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**Conclusion Q5**

TBA

**Parameter *applyTCI-StateDL-List-r17***

RAN2 notes there is discrepancy with the description and comment related to *applyTCI-State-DL-List-r17*. RAN2 has baseline implementation for this functionality where 1 bit “followUnifiedTCI-State" indication is added to “AssociatedReportConfigInfo” IE where QCL per an aperiodic resource set is currently configured i.e. all resource within NZP-CSI-RS resource set follow unified TCI state in DCI.

---\*\*\*---

**Question 1.4:** Is this RRC parameter implementation is according to intended functionality or should the indication be placed per NZP-CSI-RS resource set or resource. Note that these NZP-CSI-RS resource sets and resource configurations are not specific to AP?

Note that it will be RAN2 signalling design whether supporting this functionality is 1 bit indication per field X, or by maintaining lists of field X.

**Answer 1.4:**

It is not fully aligned with the intended functionality. RAN1 has agreed that only aperiodic CSI-RS for beam management and aperiodic CSI-RS for CSI acquisition can follow the indicated Rel-17 TCI state, which can all be configured using CSI-AssociatedReportConfigInfo. RAN1 has also agreed that periodic CSI-RS, and semi-persistent CSI-RS (therefore CSI-RS for tracking) never follow the indicated Rel-17 TCI state. Provided that these restrictions are captured in the field description of followUnifiedTCI-State in CSI-AssociatedReportConfigInfo, the proposed RRC implementation would be fine.

**Rapporteur comment:** It is suggested to add in field description “for channel measurements” and used Con Aperiodic for the field.

#### – *CSI-AperiodicTriggerStateList*

The *CSI-AperiodicTriggerStateList* IE is used to configure the UE with a list of aperiodic trigger states. Each codepoint of the DCI field "CSI request" is associated with one trigger state (see TS 38.321 [3], clause 6.1.3.13). Upon reception of the value associated with a trigger state, the UE will perform measurement of CSI-RS, CSI-IM and/or SSB (reference signals) and aperiodic reporting on L1 according to all entries in the *associatedReportConfigInfoList* for that trigger state.

*CSI-AperiodicTriggerStateList* information element

-- ASN1START

-- TAG-CSI-APERIODICTRIGGERSTATELIST-START

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

CSI-AperiodicTriggerState ::= SEQUENCE {

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

 ...

}

CSI-AssociatedReportConfigInfo ::= SEQUENCE {

 reportConfigId CSI-ReportConfigId,

 resourcesForChannel CHOICE {

 nzp-CSI-RS SEQUENCE {

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

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

 OPTIONAL -- Cond Aperiodic

 },

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

 },

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

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

 ... ,

 [[

 followUnifiedTCIstate-r17 ENUMERATED {enabled} OPTIONAL, -- ~~Need R~~ Cond Aperiodic

 ~~-- Editor’s note: OPTION 2: at CSI hypothesis level, which means each CSI hypothesis can separately be configuredd~~

 ~~-- Editor’s note: this applies only to CMR~~

 ~~-- Editor’s note: FFS on further input if this is the correct placement~~

 qcl-infoUnifiedTCIstate-r17 SEQUENCE (SIZE(1..maxNrofAP-CSI-RS-ResourcesPerSet)) OF DLorJoint-TCIState-Id-r17

-- Editor’s note: If this is configured UE ignores qcl-info

-- Editor’s note: Not needed if id space of Rel15/16 TCI state is reused.

 ap-CSI-MultiplexingMode-r17 ENUMERATED {enabled} OPTIONAL, -- Need R

 resourcesForChannel2-r17 CHOICE {

 nzp-CSI-RS2-r17 SEQUENCE {

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

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

 OPTIONAL -- Cond Aperiodic

 },

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

 } OPTIONAL -- Need R

 ]]

}

-- TAG-CSI-APERIODICTRIGGERSTATELIST-STOP

-- ASN1STOP

|  |
| --- |
| *CSI-AssociatedReportConfigInfo* field descriptions |
| ***ap-CSI-MultiplexingMode***Indicates if the behavior of transmitting AP-CSI on the first PUSCH repetitions corresponding to two SRS resource sets is enabled or not.  |
| ***csi-IM-ResourcesForInterference****CSI-IM-ResourceSet* for interference measurement. Entry number in csi-IM-ResourceSetList in the CSI-ResourceConfig indicated by *csi-IM-ResourcesForInterference* in the *CSI-ReportConfig* indicated by *reportConfigId* above (value 1 corresponds to the first entry, value 2 to the second entry, and so on). The indicated *CSI-IM-ResourceSet* should have exactly the same number of resources like the *NZP-CSI-RS-ResourceSet* indicated in *resourceSet* within *nzp-CSI-RS*. |
| ***csi-SSB-ResourceSet***CSI-SSB-ResourceSet for channel measurements. Entry number in *csi-SSB-ResourceSetList* in the *CSI-ResourceConfig* indicated by *resourcesForChannelMeasurement* in the *CSI-ReportConfig* indicated by *reportConfigId* above (value 1 corresponds to the first entry, value 2 to the second entry, and so on). |
| ***followUnifiedTCIstate***Indicates whether the nzp-CSI-RS for channel measurements follows the unified TCI state of the “indicated TCI state” as specified in TS 38.214 Clause 5.1.5. If this field is present, UE ignores qcl-info configured for the nzp-CSI-RS for resourceForChannel. |
| ***nzp-CSI-RS-ResourcesForInterference****NZP-CSI-RS-ResourceSet* for interference measurement. Entry number in *nzp-CSI-RS-ResourceSetList* in the *CSI-ResourceConfig* indicated by *nzp-CSI-RS-ResourcesForInterference* in the *CSI-ReportConfig* indicated by *reportConfigId* above (value 1 corresponds to the first entry, value 2 to the second entry, and so on).  |
| ***qcl-info***List of references to TCI-States for providing the QCL source and QCL type for each *NZP-CSI-RS-Resource* listed in *nzp-CSI-RS-Resources* of the *NZP-CSI-RS-ResourceSet* indicated by *resourceSet* within *nzp-CSI-RS*. Each *TCI-StateId* refers to the *TCI-State* which has this value for *tci-StateId* and is defined in *tci-StatesToAddModList* in the *PDSCH-Config* included in the *BWP-Downlink* corresponding to the serving cell and to the DL BWP to which the *resourcesForChannelMeasuremen*t (in the *CSI-ReportConfig* indicated by *reportConfigId* above) belong to. First entry in *qcl-info* corresponds to first entry in *nzp-CSI-RS-Resources* of that *NZP-CSI-RS-ResourceSet*, second entry in *qcl-info* corresponds to second entry in *nzp-CSI-RS-Resources*, and so on (see TS 38.214 [19], clause 5.2.1.5.1) |
| ***reportConfigId***The *reportConfigId* of one of the *CSI-ReportConfigToAddMod* configured in *CSI-MeasConfig* |
| ***resourcesForChannel2***Configures reference signals for channel measurement corresponding to the second resource set for L1-RSRP measurement as configured in IE *CSI-ResourceConfig* when *nrofReportedGroups-r17* is configured in IE *CSI-ReportConfig*. If this is present, *resourcesForChannel* configures the reference signals for channel measurement corresponding to the first resource set for L1-RSRP measurement (see TS 38.214 [19], clause 5.2.1.4). |
| ***resourceSet****NZP-CSI-RS-ResourceSet* for channel measurements. Entry number in *nzp-CSI-RS-ResourceSetList* in the *CSI-ResourceConfig* indicated by *resourcesForChannelMeasurement* in the *CSI-ReportConfig* indicated by r*eportConfigId* above (value 1 corresponds to the first entry, value 2 to the second entry, and so on). |

|  |  |
| --- | --- |
| Conditional Presence | Explanation |
| *Aperiodic* | The field is mandatory present if the *NZP-CSI-RS-Resources* in the associated *resourceSet* have the resourceType aperiodic. The field is absent otherwise. |
| *CSI-IM-ForInterference* | This field is mandatory present if the *CSI-ReportConfig* identified by *reportConfigId* is configured with *csi-IM-ResourcesForInterference*; otherwise it is absent. |
| *NZP-CSI-RS-ForInterference* | This field is mandatory present if the *CSI-ReportConfig* identified by *reportConfigId* is configured with *nzp-CSI-RS-ResourcesForInterference*; otherwise it is absent. |

**Q6: Please respond if you think the suggested resolution needs to revised? (if you are ok with suggestion no need to respond)**

|  |  |
| --- | --- |
| Company | Suggested revision |
| Intel | We propose a small addition. ***followUnifiedTCIstate***Indicates whether the nzp-CSI-RS for channel measurements follows the unified TCI state of the indicated DL only/Joint TCI state” as specified in TS 38.214 Clause 5.1.5. If this field is present, UE ignores qcl-info configured for the nzp-CSI-RS for resourceForChannel.We also prefer to change parameter name to be more specific (e.g. followUnifiedTCIstateAP-CSI-r17) considering this parameter is also used in PHY spec where upper IE is not visible.  |
| OPPO | Fine with change by Intel. Not sure about the additional condition “Aperiodic” since this IE structure is for aperiodic CSI RS specifically.RAN1’s answer suggests that this IE is not applicable for periodic and SP CSI-RS. In current running CR there is a condition “periodic” for newly added IE “qcl-InfoUnifiedTCIPeriodicCSI-RS-r17”, we wonder whether this condition should be changed for both periodic and SP CSI-RS? |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**Conclusion Q6**

TBA

**Parameter ApplyTCI-State-r17forSRS**

RAN2 intends to add the parameter “*followUnifiedTCI-State-r17*” (*ApplyTCI-State-r17forSRS* in RAN1 RRC parameter list) to *SRS-ResourceSet* IE according to RAN1 guidance.

---\*\*\*---

**Question 1.5:** Are the stated restrictions indicated in the L1 parameter excel (i.e. “This applies to the following: 1) Aperiodic SRS for BM, 2) SRS (of any time-domain behavior) for codebook, non-codebook, and antenna switching “) should be placed in TS 38.331 or these will be specified by RAN1? If they should be specified in RAN2, are there any additional restrictions that have not yet been communicated?

**Answer 1.5:**

RAN1 is okay to implement the stated restrictions in TS 38.331, and there are no additional restrictions. If there are new restrictions agreed, RAN1 will communicate them to RAN2.

---\*\*\*---

**Question 1.6:** RAN2 would also like to confirm whether also semi-persistent SRS (as RAN1 mentioned “of any time-domain behaviour) will follow unified TCI state in DCI or some coordination between RRC signalling, MAC CE and DCI is needed?

**Answer 1.6:**

For AP/SP/P SRS for codebook/non-codebook/antenna switching, it can also be configured by RRC on whether to follow Rel-17 indicated TCI.

Regarding to SRS for BM, only AP SRS for BM can be configured by RRC on whether to follow Rel-17 indicated TCI. Thus, if the parameter “followUnifiedTCI-State-r17” is used, then the restriction should be captured by RAN2 that it cannot be configured or applied when the SRS for BM is transmitted in SP/P manner.

**Rapporteur comment:** In a similar manner, the below field description is suggested to be added to the parameter already implemented for SRS-Resource in the RRC CR.

***followUnifiedTCIstate***

This parameter indicates whether this CORESET follows the unified TCI state of the “indicated TCI state” as specified in TS 38.214 Clause 5.1.5. This parameter may be configured for aperiodic SRS for BM or SRS of any time-domain behavior for codebook, non-codebook, and antenna switching.

**Q7: Please respond if you think the suggested field description needs to revised already in this meeting? (if you are ok with suggestion no need to respond)**

|  |  |
| --- | --- |
| Company | Suggested revision |
| Intel | We propose some changes as follows. This parameter indicates whether SRS resources ~~this~~ ~~CORESET~~ follows the unified TCI state of the “indicated UL only/joint TCI state” as specified in TS 38.214 Clause 5.1.5. This parameter may be configured for aperiodic SRS for BM or SRS of any time-domain behavior for codebook, non-codebook, and antenna switching. In addition, we prefer to change parameter name to be more specific (e.g. followUnifiedTCIstateSRS-r17) considering this parameter is also used in PHY spec where upper IE is not visible.  |
| OPPO | This new IE is added in SRS-ResourceSet instead of SRS-Resource which should be reflected in the field description.In addition we are wondering whether a similar parameter like “qcl-InfoUnifiedTCIPeriodicCSI-RS-r17” should be also added in SRS-ResourceSet for periodic and SP SRS for beam management. Note RAN1 confirmed that within one serving cell either Rel16 TCI state framework or R17 unified TCI state frame work will be configured. So if “followUnifiedTCIstate-r17” is not applicable, then QCL information should be configured with RRC signaling, or ? |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**Conclusion Q7**

TBA

**MPE**

**Question 1.7:** Please clarify the structure of the *mpe-ResourcePool*: Is it a list of SSB or CSI-RS resources (i.e. SSBRI or CRI), and what is the maximum number of resources configured in the pool?

**Answer 1.7:**

It should be a list/set of SSB or CSI-RS resources index. Each SSB or CSI-RS resource index must also be associated with a serving cell index. RAN1 doesn’t preclude the re-use of existing IEs for the CSI-RS/SSB resource sets.

There is no RAN1 agreement, on the maximum number of resources in the pool. The maximum number of resources is 64.

---\*\*\*---

**Question 1.8:** Does the enhanced MPE reporting applies also to mTRP operation, and, if it does, will this be configured by *mpe-Reporting-FR2* or is another RRC configuration needed?

**Answer 1.8:**

RAN1 are still discussing and are considering the two alternatives below (exact formulations TBD)

***Alt1.***

Note that enhanced MPE reporting and the multi-TRP PHR enhancement are two different features in Rel-17. Hence, the enhanced MPE reporting cannot be combined with the multi-TRP PHR specified in Rel-17. In addition, the enhanced MPE reporting can be applied to mTRP operation as long as the mTRP PHR is not enabled. Note that there is no problem to reuse MAC CE structure defined for mTRP if RAN2 finds it beneficial.

***Alt.2***

The enhanced MPE reporting can be applied to mTRP operation, and enhanced MPE reporting can be combined with mTRP PHR reporting specified in Rel-17’

---\*\*\*---

**Question 1.9:** RAN1 to confirm whether the RAN2 should keep the MPE-Config-FR2-r17 in the PHR-Config IE, which is per cell group, or move it to (per-cell) per BWP level as indicated in L1 parameter excel?

**Answer 1.9:**

The enhanced MPE reporting doesn't impact how the PHR-Config is provided, and RAN2 can keep the MPE-Config-FR2-r17 in the PHR-Config IE, which is per cell group. The mpe-ResourcePool-r17 under MPE -Config-FR2-r17 should be BWP /CC-specific.

---\*\*\*---

**Question 1.10:** Is reporting of PCMax,f,c needed for MPE information and if it is, should it be included per indicated SSBRI/CRI value or is it cell-specific?

**Answer 1.10**:

RAN1 is still discussing and more time is needed.

**Rapporteur comment:** Unfortunately the responses regarding cellINdex are slightly contradicting. That is, it is not clear if cellIndex configuration is per ResourcePool or per individual resource. Safest is to include the cellIndex per resource.

-- TAG-PHR-CONFIG-START

PHR-Config ::= SEQUENCE {

 phr-PeriodicTimer ENUMERATED {sf10, sf20, sf50, sf100, sf200,sf500, sf1000, infinity},

 phr-ProhibitTimer ENUMERATED {sf0, sf10, sf20, sf50, sf100,sf200, sf500, sf1000},

 phr-Tx-PowerFactorChange ENUMERATED {dB1, dB3, dB6, infinity},

 multiplePHR BOOLEAN,

 dummy BOOLEAN,

 phr-Type2OtherCell BOOLEAN,

 phr-ModeOtherCG ENUMERATED {real, virtual},

 ...,

 [[

 mpe-Reporting-FR2-r16 SetupRelease { MPE-Config-FR2-r16 } OPTIONAL -- Need M

 ]] ,

 [[

 mpe-Reporting-FR2-r17 SetupRelease { MPE-Config-FR2-r17 } OPTIONAL, -- Need M

 twoPHRMode-r17 ENUMERATED {enabled} OPTIONAL -- Need R

 ]]

}

MPE-Config-FR2-r16 ::= SEQUENCE {

 mpe-ProhibitTimer-r16 ENUMERATED {sf0, sf10, sf20, sf50, sf100, sf200, sf500, sf1000},

 mpe-Threshold-r16 ENUMERATED {dB3, dB6, dB9, dB12}

}

MPE-Config-FR2-r17 ::= SEQUENCE {

 mpe-ProhibitTimer-r17 ENUMERATED {sf0, sf10, sf20, sf50, sf100, sf200, sf500, sf1000},

 mpe-Threshold-r17 ENUMERATED {dB3, dB6, dB9, dB12},

 numberOfN-r17 INTEGER{1..4},

 mpe-ResourcePool-r17 SEQUENCE (SIZE(1..maxMPE-Resources-r17)) OF MPE-Resource-r17,

 ...

}

MPE-Resource-r17 ::= SEQUENCE {

 mpe-ResourceId-r17 INTEGER (1..maxMPE-Resources-r17),

 cell ServCellIndex OPTIONAL, -- Need R

 mpe-ReferenceSignal-r17 CHOICE {

 csi-RS-Resource-r17 NZP-CSI-RS-ResourceId,

 ssb-Resource-r17 SSB-Index

 }

}

***mpe-ResourcePool***

List of SSB/CSI-RS resources for P-MPR reporting. Each resource is configured with serving cell index where the resource is configured for the UE. FFS further details

**Q8: Please respond if you think the suggested resolution needs to revised already in this meeting? (if you are ok with suggestion no need to respond)**

|  |  |
| --- | --- |
| Company | Suggested revision |
| Intel | Regarding A1.7, we are waiting for our RAN1’s input on the exact meaning. Our understanding is although RAN1 response is contradicting and ambiguous. It can be included up to 64 per mpe resource pool i.e. the maximum number of resources in mpe-ResourcePool-r17 per BWP per CC is 64. Regarding A1.8, RAN1 reply LS actually override it. That is, MPE reporting is not supported for mTRP. (for now). RAN1 has the following reply to the RAN2 questions:* Regarding inter-cell beam management (ICBM), RAN1 confirms that these RRC parameters including mpe-Reporting-FR2-r17, numberOfN and mpe-ResourcePool apply to the ICBM framework as well.
* Regarding mTRP framework, RAN1 has not discussed whether these MPE reporting changes would also apply to mTRP framework.

Regarding A1.9, mpe-ResourcePool-r17 should be defined per CC/per BWP (i.e. moved to PUSCH config). Regarding A1.10, since it is more related to MAC format, there is no impact to RRC signaling.  |
| LGE | On A1.7, we support per-resource configuration.On A1.8, we agree with Intel. RAN1 answers in the latest LS in R2-2204044:*Note that enhanced MPE reporting and the multi-TRP PHR enhancement are two different features in Rel-17. From RAN1 perspective, there is no consensus that enhanced MPE reporting can be combined with the multi-TRP PHR specified in Rel-17. Furthermore, RAN1 does not plan to specify any additional specification enhancement for the combination of these two features*From this answer, we think that enhanced MPE reporting is not applied to mTRP. On A1.9, we agree with Intel. On A.10, we agree with Intel.  |
| OPPO | A1.7 and A1.10 are more related to MAC CE design. In email discussion [016] 64 is assumed per source pool which is in safe side considering the ambiguous answer from RAN1.We intend to agree with Intel that MPE reporting is not supported for mTRP. Note this is also RAN1’s last meeting.Moderator’s suggestion to add serving cell index is bit strange since RAN1 say in A1.9 it should be per BWP/CC. so to put in PUSCHConfig is fine for us. |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**Conclusion Q8**

TBA

**BeamAppTime value range**

---\*\*\*---

**Question 1.11:** RAN2 would like to further confirm whether this parameter is per-UE (i.e. applicable to all cell groups per SCS), per cell group (i.e. within the same cell group, all cells use the same values per SCS), per cell (i.e. different cells may use different value per SCS), or something else?

**Answer 1.11:**

RAN1 only has agreed that the BAT shall be the same for all the CCs configured with the common TCI state ID update based on the smallest SCS of the active BWP. How to provide the BAT for CA is currently under discussion in RAN1, and RAN1 will inform to RAN2 as early as possible if any conclusion is made.

---\*\*\*---

**Question 1.12:** Is it correct understanding that the common TCI state ID update is when the same TCI state list is configured for multiple CCs with reference BWP/CC?

**Answer 1.12:**

The understanding is not correct. Common TCI state ID update can be configured not only when the same TCI state list is configured for multiple BWPs/CCs with reference BWP/CC, but also when TCI state list is provided for each BWP/CC as in Rel-15/16

---\*\*\*---

**Question 1.13:** Please indicate what should be the value range for parameter *beamAppTime-r17?*

**Answer 1.13:**

RAN1 has agreed the following:

**Agreement**

The value range of beamAppTime-r17 is (1, 2, 4, 7, 14, 28, 42, 56, 70, 84, 98, 112, 224, 336) symbols.

* Discuss the applicability of 84, 98, 112, 224, 336 for FR2/FR2-2 in UE features session
	+ These values are not applicable for FR1

-- TAG-PDSCH-CONFIG-START

PDSCH-Config ::= SEQUENCE {

\*\*\* OMITTED\*\*\*

 ,

 [[

 DLorJoint-TCIState-ToAddModList-r17 SEQUENCE (SIZE (1..max-DLorJointTCI-r17)) OF DLorJoint-TCIState-r17 OPTIONAL, -- Need N

 DLorJoint-TCIState-ToReleaseList-r17 SEQUENCE (SIZE (1..max-DLorJointTCI-r17)) OF DLorJoint-TCIState-Id-r17 OPTIONAL, -- Need N

 refUnifiedTCIStateList-r17 RefUnifiedTCIStateList-r17 OPTIONAL, -- Need R

 --editor’s note: final implementation depends on RAN1 response, e.g. using CHOICE or UL behaviour

 beamAppTime-r17 ENUMERATED{n1, n2, n4, n7, n14, n28, n42, n56, n70, n84, n98, n112, n224, n336} OPTIONAL, -- Need R

 sfnSchemePdsch-r17 ENUMERATED {sfnSchemeA,sfnSchemeB} OPTIONAL -- Need R

 ]]

}

***beamAppTime***

Indicates the first slot to apply the unified TCI indicated by DCI as specified in TS 38.214 Clause 5.1.5. The value n1 means 1 symbol, n2 two symbols and so on. The first slot is at least Y symbols indicated by beamAppTime parameter after the last symbol of the acknowledgment of the joint or separate DL/UL beam indication. ~~The beamAppTime configured by the gNB based on UE capability, which is also reported in units of symbols.(See 38.214 Clause 5.1.5)~~

**Q9: Please respond if you think the suggested resolution needs to revised already in this meeting? (if you are ok with suggestion no need to respond)**

|  |  |
| --- | --- |
| Company | Suggested revision |
| Intel | Regarding A1.11, although RAN1 said it is under discussion, we are informed that RAN1 also agreed to have BAT per CC/BWP when common TCI state ID update is not applied. Therefore, we are ok to put BAT in PDSCH-Config. The field description should add that BAT shall be the same for all the CCs configured with the common TCI state ID update based on the smallest SCS of the active BWP.Based on A1.13, BAT value range looks ok.  |
| LGE | We agree with Intel on the placement of the beamAppTime under PDSCH-Config, to support BAT per CC/BWP. We agree with Intel that the FD of BAT should capture the restriction indicated by A1.11.  |
| OPPO | Agree with Intel |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**Conclusion Q9**

TBA

In current running RRC CR the PO set(P0, alpha, closed loop index) is encoded in both UL TCI state as well in *BWP-UL-Dedicated* (that is outside of UL TCI state) and different values are enabled for each UL channel PUSCH, PUCCH, SRS. UE receives the UL pc configuration in either UL TCI states or in BWP UL-dedicated.

---\*\*\*---

**Question 1.15:** Is it correct understanding that network may provide UE the UL pc configuration in either UL TCI states or in *BWP-UL-dedicated* or should RAN2 choose one? If UL PC configuration is signalled in BWP-UL-dedicated only, how can the specific PC configuration (actually applied) be decided in PHY layer?

**Answer 1.15:**

RAN1 has reached agreement that it should be possible to associate the UL pc configuration with a UL or joint TCI state. RAN1 also agreed not to include the UL pc configuration in an UL or joint TCI state. Therefore, UL pc configuration should not be provided in an UL or joint TCI state.

However, the agreement also states that it should be possible to not configure any association, meaning that irrespective of which UL or joint TCI state is currently indicated, the same set of channel/RS-specific PC parameters should be used for each of the PUSCH, PUCCH, and SRS.. Implementing the UL PC configuration in the UL BWP provides the desired functionality. In the field descriptions, it could be stated that the NW should configure the PC parameters in the UL BWP.

**Rapporteur comment:** The response is both hilarious and unclear. With best of intentions, it could be interpreted that current RRC CR implementation is according to the functionality RAN1 has intended.

**Q10: Please respond if you think the current RRC CR implementation needs to be changed.**

|  |  |
| --- | --- |
| Company | Suggested revision |
| Intel | First, we agree with rapporteur’s comment. 😊Actual RAN1 agreement is easier to understand. On the setting of UL PC parameters except for PL-RS (P0, alpha, closed loop index) for Rel.17 unified TCI framework,* For each of PUSCH and PUCCH, the setting of (P0, alpha, closed loop index) can be associated with UL or (if applicable) joint TCI state per BWP.
	+ In this case, multiple settings are configured. Each setting can be associated with at least one TCI state, and, for a given TCI state, only one setting for PUSCH and only one setting for PUCCH can be associated at a time.
* If not associated, for each of the PUSCH and PUCCH, the setting(s) of (P0, alpha, closed loop index) per channel/signal per BWP is independent of the UL or (if applicable) joint TCI states

Based on RAN1 agreement, we have one list of UL PC sets under PUSCH-Config. In each TCI state (joint and UL only TCI state) includes PC index to associate with one of UL PC set. In addition, if there is any association, gNB should provide only one PC set in UL PC set list that is used independent of TCI state.  |
| LGE | To support the non-association case, the current running CR implementation is sufficient, but some FD or Cond should be captured to indicate when the field is configured. To support the association case, we need to be able to configure a) a list of UL PC param sets and b) association between the UL PC param sets and UL/joint TCI states. The intel’s suggestion is fine, and the other way would be to have a) the list of UL PCparam sets under ServingCellConfig and b\_alt1) a pointer to a particular UL PC set in each TCI state, or b\_alt2) a pointer to a particular TCI state in each entry of PC param sets  |
| OPPO | We share bit similar view as Intel in general. For the case of absence of PC set index within joint or UL only TCI state, one PC set should be defined. RAN1’s response before suggests that it can be put in BWP-UplinkDedicated. But we think to put similar parameter in different place is not friendly ASN.1. Instead one PC set e.g. the index 0 of the PC set list can be taken as a default value for joint or UL only TCI state without any associated PC set. We disagree with Intel in this case only one PC set is configured since absence of associated PC set index is per TCI state but not per TCI state pool i.e. absence of PC set index should be allowed for partial TCI states. |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**Conclusion Q10**

TBA

**Question 2.2:** Should the *searchSpaceLinking* be applied to all or selected set of SearchSpaces under Rel-15 and Rel-16 configurations?

**Answer 2.2:**

RAN1 confirms that searchSpaceLinking should be applied to SearchSpaces under both Rel-15 and Rel-16 configurations. As RAN2 is aware, several limitations are agreed by RAN1, some of which are already captured in RAN1 spec. RAN1 would like to suggest RAN2 to capture the following agreements (or the highlighted parts of the last agreement below) in 38.331 as they have not been captured by RAN1 spec, and they may be more suitable to be captured by RRC spec. For other limitations that are already captured in RAN1 spec, it is up to RAN2 whether to also include them in RRC spec or not.

Related agreements:

**Agreement**

The following SS sets cannot be linked with another SS set for PDCCH repetition: *SS set 0, searchSpaceSIB1, searchSpaceOtherSystemInformation, pagingSearchSpace, ra-SearchSpace*.

**Agreement**

SS set configured by *recoverySearchSpaceId* cannot be linked to another SS set for PDCCH repetition.

**Agreement**

The following SS sets cannot be linked with another SS set for PDCCH repetition: *searchSpaceBroadcast, peiSearchSpace, and sdt-SearchSpace*.

**Agreement**

Confirm the following working assumption in RAN1 #106-bis-e:

When a scheduled CC is configured to be cross-carrier scheduled by a scheduling CC, two PDCCH candidates (with the same AL and candidate index associated with the scheduled CC) are linked only if the corresponding two SS sets in the scheduling CC are linked and two SS sets in the scheduled CC with the same SS set IDs are also linked.

* Note: The PDCCH candidates associated with the scheduled CC are defined as part of SS sets for scheduled CC instead of SS sets for scheduling CC (Same as Rel-15)

**Agreement**

For PDCCH repetition, support linking two SS sets by RRC configuration:

* FFS: Whether MAC-CE can be used additionally
* When PDCCH repetition is monitored in two linked SS sets, the UE does not expect a third monitored SS set to be linked with any of the two linked SS sets.
* The two linked SS sets have the same SS set type (USS/CSS)
	+ The two linked SS sets have the same DCI formats to monitor
* For intra-slot PDCCH repetition,
	+ The two SS sets should have the same periodicity and offset (monitoringSlotPeriodicityAndOffset), and the same duration
	+ For linking monitoring occasions across the two SS sets that exist in the same slot:
		- The two SS sets have the same number of monitoring occasions within a slot and n-th monitoring occasion of one SS set is linked to n-th monitoring occasion of the other SS set

– *SearchSpace*

The IE *SearchSpace* defines how/where to search for PDCCH candidates. Each search space is associated with one *ControlResourceSet*. For a scheduled cell in the case of cross carrier scheduling, except for *nrofCandidates*, all the optional fields are absent (regardless of their presence conditions).

***SearchSpace* information element**

-- ASN1START

-- TAG-SEARCHSPACE-START

SearchSpace ::= SEQUENCE {

 searchSpaceId SearchSpaceId,

 controlResourceSetId ControlResourceSetId OPTIONAL, -- Cond SetupOnly

 monitoringSlotPeriodicityAndOffset 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),

 sl40 INTEGER (0..39),

 sl80 INTEGER (0..79),

 sl160 INTEGER (0..159),

 sl320 INTEGER (0..319),

 sl640 INTEGER (0..639),

 sl1280 INTEGER (0..1279),

 sl2560 INTEGER (0..2559)

 } OPTIONAL, -- Cond Setup

 duration INTEGER (2..2559) OPTIONAL, -- Need R

 monitoringSymbolsWithinSlot BIT STRING (SIZE (14)) OPTIONAL, -- Cond Setup

 nrofCandidates SEQUENCE {

 aggregationLevel1 ENUMERATED {n0, n1, n2, n3, n4, n5, n6, n8},

 aggregationLevel2 ENUMERATED {n0, n1, n2, n3, n4, n5, n6, n8},

 aggregationLevel4 ENUMERATED {n0, n1, n2, n3, n4, n5, n6, n8},

 aggregationLevel8 ENUMERATED {n0, n1, n2, n3, n4, n5, n6, n8},

 aggregationLevel16 ENUMERATED {n0, n1, n2, n3, n4, n5, n6, n8}

 } OPTIONAL, -- Cond Setup

 searchSpaceType CHOICE {

 common SEQUENCE {

 dci-Format0-0-AndFormat1-0 SEQUENCE {

 ... ,

 [[

 searchSpaceLinkingId-r17 SearchSpaceLinkingId OPTIONAL -- Need R

 ]]

 } OPTIONAL, -- Need R

 dci-Format2-0 SEQUENCE {

 nrofCandidates-SFI SEQUENCE {

 aggregationLevel1 ENUMERATED {n1, n2} OPTIONAL, -- Need R

 aggregationLevel2 ENUMERATED {n1, n2} OPTIONAL, -- Need R

 aggregationLevel4 ENUMERATED {n1, n2} OPTIONAL, -- Need R

 aggregationLevel8 ENUMERATED {n1, n2} OPTIONAL, -- Need R

 aggregationLevel16 ENUMERATED {n1, n2} OPTIONAL -- Need R

 },

 ... ,

 [[

 searchSpaceLinkingId-r17 SearchSpaceLinkingId OPTIONAL -- Need R

 ]]

 } OPTIONAL, -- Need R

 dci-Format2-1 SEQUENCE {

 ... ,

 [[

 searchSpaceLinkingId-r17 SearchSpaceLinkingId OPTIONAL -- Need R

 ]]

 } OPTIONAL, -- Need R

 dci-Format2-2 SEQUENCE {

 ... ,

 [[

 searchSpaceLinkingId-r17 SearchSpaceLinkingId OPTIONAL -- Need R

 ]]

 } OPTIONAL, -- Need R

 dci-Format2-3 SEQUENCE {

 dummy1 ENUMERATED {sl1, sl2, sl4, sl5, sl8, sl10, sl16, sl20} OPTIONAL, -- Cond Setup

 dummy2 ENUMERATED {n1, n2},

 ... ,

 [[

 searchSpaceLinkingId-r17 SearchSpaceLinkingId OPTIONAL -- Need R

 ]]

 } OPTIONAL -- Need R

 },

 ue-Specific SEQUENCE {

 dci-Formats ENUMERATED {formats0-0-And-1-0, formats0-1-And-1-1},

 ...,

 [[

 dci-Formats-MT-r16 ENUMERATED {formats2-5} OPTIONAL, -- Need R

 dci-FormatsSL-r16 ENUMERATED {formats0-0-And-1-0, formats0-1-And-1-1, formats3-0, formats3-1,

 formats3-0-And-3-1} OPTIONAL, -- Need R

 dci-FormatsExt-r16 ENUMERATED {formats0-2-And-1-2, formats0-1-And-1-1And-0-2-And-1-2}

 OPTIONAL -- Need R

 ]],

 [[

 searchSpaceLinkingId-r17 SearchSpaceLinkingId OPTIONAL -- Need R

 ]]

 }

 } OPTIONAL -- Cond Setup2

}

SearchSpaceLinkingId-r17 ::= INTEGER (0..maxNrofSearchSpacesLinks-1)

~~--Editor’s note: Implementation of searchSpaceLinkingId is pending on further information from RAN1~~

SearchSpaceExt-r16 ::= SEQUENCE {

 controlResourceSetId-r16 ControlResourceSetId-r16 OPTIONAL, -- Cond SetupOnly2

 searchSpaceType-r16 SEQUENCE {

 common-r16 SEQUENCE {

 dci-Format2-4-r16 SEQUENCE {

 nrofCandidates-CI-r16 SEQUENCE {

 aggregationLevel1-r16 ENUMERATED {n1, n2} OPTIONAL, -- Need R

 aggregationLevel2-r16 ENUMERATED {n1, n2} OPTIONAL, -- Need R

 aggregationLevel4-r16 ENUMERATED {n1, n2} OPTIONAL, -- Need R

 aggregationLevel8-r16 ENUMERATED {n1, n2} OPTIONAL, -- Need R

 aggregationLevel16-r16 ENUMERATED {n1, n2} OPTIONAL -- Need R

 },

 ...

 } OPTIONAL, -- Need R

 dci-Format2-5-r16 SEQUENCE {

 nrofCandidates-IAB-r16 SEQUENCE {

 aggregationLevel1-r16 ENUMERATED {n1, n2} OPTIONAL, -- Need R

 aggregationLevel2-r16 ENUMERATED {n1, n2} OPTIONAL, -- Need R

 aggregationLevel4-r16 ENUMERATED {n1, n2} OPTIONAL, -- Need R

 aggregationLevel8-r16 ENUMERATED {n1, n2} OPTIONAL, -- Need R

 aggregationLevel16-r16 ENUMERATED {n1, n2} OPTIONAL -- Need R

 },

 ...

 } OPTIONAL, -- Need R

 dci-Format2-6-r16 SEQUENCE {

 ...

 } OPTIONAL, -- Need R

 ... ,

 [[

 searchSpaceLinkingId-r17 SearchSpaceLinkingId OPTIONAL -- Need R

 ]]

 }

 } OPTIONAL, -- Cond Setup3

 searchSpaceGroupIdList-r16 SEQUENCE (SIZE (1.. 2)) OF INTEGER (0..1) OPTIONAL, -- Need R

 freqMonitorLocations-r16 BIT STRING (SIZE (5)) OPTIONAL -- Need R

}

-- TAG-SEARCHSPACE-STOP

-- ASN1STOP

***SearchSpaceLinkingId***

This parameter is used to link two search spaces of same type. If two search spaces have the same SearchSpaceLinkingId UE assumes these search spaces are linked to PDCCH repetition REF. When PDCCH repetition is monitored in two linked search space sets, the UE does not expect a third monitored SS set to be linked with any of the two linked SS sets. The two linked SS sets have the same SS set type (USS/CSS). The two linked SS sets have the same DCI formats to monitor. For intra-slot PDCCH repetition: The two SS sets should have the same periodicity and offset (monitoringSlotPeriodicityAndOffset), and the same duration. For linking monitoring occasions across the two SS sets that exist in the same slot: The two SS sets have the same number of monitoring occasions within a slot and n-th monitoring occasion of one SS set is linked to n-th monitoring occasion of the other SS set. The following SS sets cannot be linked with another SS set for PDCCH repetition: SS set 0, searchSpaceSIB1, searchSpaceOtherSystemInformation, pagingSearchSpace, ra-SearchSpace. SS set configured by recoverySearchSpaceId cannot be linked to another SS set for PDCCH repetition.

**Q11: Please respond if you have further suggestions to improve the above implementation**

|  |  |
| --- | --- |
| Company | Suggested revision |
| Intel |  To our understanding, shouldn’t we move searchSpaceLinkingId-r17 as a general parameter under SearchSpace IE? We think searchSpaceLinking should not be defined inside the “choice” per each DCI format (as in current running RRC CR). Instead, it should be defined per SS set.  |
| LGE | We are still checking this with our RAN1 colleague, but for now we tend to agree with Intel.  |
| OPPO | We agree with Intel that single searchSpaceLinkingId-r17 in one search space is sufficient. This is because linkage between search spaces is exclusive as indicated by RAN1. The field description about applicable DCI format is sufficient to indicate what some DCI format is not applicable.In addition the term “search space set” is RAN1 term. In RRC what is linked is two search space. So we’d better not to use “search space set” in the field description |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**Conclusion Q11**

TBA

**Question 2.4:** Please inform how to implement beam failure detection RS sets for mTRP. Also what is the maximum number of detection resources to be configured per UE per cell or per TRP? What is the maximum number of recovery resources to be configured per UE per cell or per TRP?

**Answer 2.4:**

RAN1 agreed to support both explicit and implicit beam failure detection (BFD) RS sets configurations for mTRP, and the implicit BFD RS sets can only be configured for mDCI based mTRP (i.e., when PDCCH-Config contains two different values of coresetPoolIndex). The two beam failure detection RS sets are to be configured per DL BWP (BWP-DonwlinkDedicated).

For implicit configuration, the UE determines the two BFD RS sets including periodic CSI-RS resource configuration indexes having the same values as the source RS indexes in the TCI states for the CORESETs associated with respective pool indexes 0 and 1.

Details on explicit configuration (RRC, MAC-CE or RRC+MAC-CE) are still under discussion in RAN1. RAN1 will notify RAN2 after RAN1 reach any consensus.

The maximum number of detection resources per set per CC is 64, which is subject to UE capability.

**Q12: Please give your suggestion how to configure this feature?**

|  |  |
| --- | --- |
| Company | Suggested revision |
| Intel | For implicit configuration, we don’t need any further RRC parameters but only field description would be needed to determine two BFD-RS sets. For explicit configuration, let’s wait for RAN1 conclusion.  |
| OPPO | Wait for RAN1 further conclusion. |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**Conclusion Q12**

TBA

# 5 Conclusion

# References

1. R2-2202000, “Running RRC CR MIMO” RAN2#116bis
2. R2-2202055 annotated L1 parameters RAN2#116bis
3. R2-2202002, LS on feMIMO RRC parameters, RAN2#116bis
4. R2-2202001, RRC open issues list, RAN2#116bis
5. R1-2112840 MAC CE impacts

Annex agreements

List of RAN2 agreements

RAN2#115

* MAC entity maintains separate beamFailureDetectionTimer and BFI\_COUNTER for each BFD-RS set of a serving cell configured with multiple BFD-RS sets.
* beamFailureDetectionTimer and beamFailureInstanceMaxCount configuration is configured independently for each TRP of serving cell.
* If the MAC entity receives beam failure instance indication for a BFD-RS set of a serving cell, it shall perform the following:

- (re-)start beamFailureDetectionTimer corresponding to that BFD-RS set of the serving cell;

- increment BFI\_COUNTER corresponding to that BFD-RS set of the serving cell by 1.

- If BFI\_COUNTER >= beamFailureInstanceMaxCount corresponding to that BFD-RS set of the serving cell:

- trigger a BFR for the BFD-RS set of the Serving Cell;

For the case of both intra cell and inter cell:

* BFD-RS set ID is included in BFR MAC CE to identify the failed TRP.

For the case of intra cell (FFS for inter cell).

* If beam failure is detected on both TRPs (i.e. BFD-RS sets) of an SCell, BFR is triggered for that SCell.

- FFS whether UE transmits a) legacy BFR MAC CE or b) new BFR MAC CE indicating both failed TRPs as well as the beam failure recovery information for both TRPs.

* If beam failure is detected on both TRPs (i.e. BFD-RS sets) of SpCell, random access procedure is initiated on SpCell.

- FFS whether UE transmits a) legacy BFR MAC CE or b) new BFR MAC CE indicating both failed TRPs as well as the beam failure recovery information for both TRPs.

* FFS what is meant in detail by “beam failure is detected on both TRPs”

RAN2#116

* RAN2 to support separate DL and UL and joint TCI state configurations. Details FFS.
* 1a: RAN2 to use the terminology "primary TRP (pTRP)" and "additional TRP (aTRP)" for RAN2 discussion purposes. FFS whether these will really be needed in Stage-2/3 specifications.
* 1b: RAN2 does not consider RLM for aTRP in Rel-17 work
* 2a: No RRM enhancements are done in Rel-17 (unless later found critical to the functionality).
* 2b: Add SSB/PCI information for ICBM as cell-level information and link unified TCI state information to that. FFS on exact Stage-3 details.
* 2c: RAN2 starts the RRC CR work based on latest RAN1 input before sending general RRC LS to RAN1.
* 3: The RAN1 parameters for "MultiBeam" are only applicable to ICBM with unified TCI framework (i.e. not to mTRP). Discuss further in Stage-3 phase how the UL PC configuration parameters are defined.
* 4: Rel-17 MPE configuration can be included in PHR-Config. Will ask R1 whether MPE information can apply to both ICBM and mTRP
* 6: RAN2 assumes "mTRP" parameters are not for ICBM and starts Stage-3 work based on that assumption. If ambiguities are found, LS can be sent to RAN1 to ask for clarification from next meeting.
* 7: RAN2 will use one RRC CR for the FeMIMO WI and start the work in post-meeting email discussion. Can discuss RRC structure during the discussion before going for final Stage-3 details.
* FFS if to Introduce the new PUCCH spatial relation activation/deactivation MAC CE for mTRP PUCCH repetition i.e. activating two spatial relation info’s (for FR2) for a group of PUCCH resources in a CC.
* RAN2 to discuss how to support PHR reporting for mTRP PUSCH repetition, and may address e.g:

New MAC CE design including the function which TRP is applied for PHR reporting.

How to incorporate the additional MPE information coming in Rel-17 to the new PHR format

Whether use legacy parameters (timer, threshold, etc.) or adding TRP specific parameters

PHR triggering conditions

* R2 assumes to revise the legacy PUSCH Pathloss Reference RS Update MAC CE with additional field(s) to differentiate the TRP for mTRP PUSCH repetition. other aspects are FFS.
* New BFR MAC CE including beam failure recovery information of both failed TRPs is transmitted when beam failure is detected for both TRPs of SCell. The Following pieces of information are included in enhanced BFR MAC CE for M-TRP BFR

Info 1: For the Identity of serving cell of failed TRP, Ci/SP fields are included.

Info 2: For indicating whether candidate beam is available or not for a failed TRP of serving cell, AC field is included.

Info 3: Candidate beam (if available) for a failed TRP is indicated by including the Candidate RS ID field.

* Both single octet bitmap (7 Ci bits and 1 SP bit) and 4 octet bitmap (31 Ci bits and 1 SP bit) formats are supported for enhanced BFR MAC CE.
* Both truncated and non-truncated enhanced BFR MAC CE are supported.
* Triggered BFRs for a BFD-RS set of a SCell shall be cancelled when a MAC PDU is transmitted and this PDU includes enhanced BFR MAC CE (or Truncated enhanced BFR MAC CE, if supported) which contains beam failure recovery information (i.e. candidate beam available or not, candidate beam if available) of that BFD-RS set of the SCell.
* if a PDCCH addressed to C-RNTI indicating uplink grant for a new transmission is received for the HARQ process used for the transmission of the enhanced BFR MAC CE which contains beam failure recovery information of a BFD-RS set of a serving cell: *BFI\_COUNTER* corresponding to the BFD-RS set of the serving cell is set to 0.
* if the SCell is deactivated, *BFI\_COUNTER* corresponding to each BFD-RS set of the serving cell is set to 0.
* if Random Access procedure initiated on SpCell due to beam failure detection on both TRPs (i.e. BFD-RS sets) of SpCell is successfully completed: *BFI\_COUNTER* corresponding to each BFD-RS set of the SpCell is set to 0.
* if the beamFailureDetectionTimer corresponding to a BFD-RS set of a serving cell expires; or if beamFailureDetectionTimer, beamFailureInstanceMaxCount, or any of the reference signals used for beam failure detection corresponding to a BFD-RS set of a serving cell is reconfigured by upper layers: BFI\_COUNTER for this BFD-RS set of the serving cell is set to 0.
* For SCell configured with multiple TRPs, SR can be triggered irrespective of whether beam failure is detected on one or both TRPs of SCell.
* For SpCell configured with multiple TRPs, SR can be triggered if beam failure is detected on only one TRP of SpCell.
* The cases for which SR is allowed (as per proposal 15, 16), SR is triggered if either of conditions a) and b) below are met:

- If UL-SCH resources are not available for a new transmission; or

- If UL-SCH resources are available for a new transmission but cannot accommodate the enhanced BFR MAC CE or enhanced truncated BFR MAC CE plus its sub header as a result of LCP.

* If a SR was triggered by BFR for a BFD-RS set of a serving cell and a MAC PDU is transmitted and this PDU includes an enhanced BFR MAC CE or a Truncated enhanced BFR MAC CE which contains beam failure recovery information for this BFD-RS set of the serving cell, pending SR is cancelled and the corresponding *sr-ProhibitTimer* is stopped, if running.
* If a SR was triggered by BFR for a BFD-RS set of an SCell and this SCell is deactivated, pending SR is cancelled and the corresponding *sr-ProhibitTimer* is stopped, if running.
* It is assumed that If beam failure is detected on both TRPs (i.e. BFD-RS sets) of an SpCell, UE initiate RACH procedure and transmits new BFR MAC CE including beam failure recovery information needed to recover both TRPs. (other options not excluded for now, it is FFS whether the UE can skip BFR information needed to recover one of the TRPs if there is not enough bits).
* The meaning of “beam failure is detected on both TRPs” is to be clarified, It is FFS which of the following options shall be applied:

Option 1 (12/17): “beam failure is detected on both TRPs” means that BFR is triggered for a TRP of the serving cell while the BFR for another TRP of same serving cell is still pending (i.e. not cancelled).

Option 2 (4/17): “beam failure is detected on both TRPs” means that BFR is triggered for a TRP of the serving cell while the BFR for another TRP of same serving cell is still pending (i.e. not successfully completed)

* Cell specific or TRP specific BFR / BFR cancellation when beam failure is detected on on both TRPs of SCell is to be determined. It is FFS which of the following options shall be applied:

Option 1(5/17): Cell specific BFR of SCell is triggered. Triggered Cell specific BFR of SCell is cancelled when BFR MAC CE containing beam failure information of both TRP of the SCell is transmitted.

Option 2 (12/17): TRP specific BFR for both the failed TRPs remains as pending. TRP specific BFR cancellation procedure (as discussed in Proposal 10) is applied for each TRP independently.

* It is FFS whether Triggered BFRs for a BFD-RS set of a SpCell shall be cancelled when a MAC PDU is transmitted and this PDU includes enhanced BFR MAC CE (or Truncated enhanced BFR MAC CE, if supported) which contains beam failure recovery information (i.e. candidate beam available or not, candidate beam if available) of that BFD-RS set of the SpCell.

RAN2#116bis

* RAN2 to conclude ““Joint DL/UL TCI” means that there is one TCI state ID for each codepoint, while “separate DL/UL TCI” means that there is one or two TCI state IDs for each codepoint.”
* P3: Can consider the R1 proposal with TCI state references, not ask q acc to P3, progress this offline.
* IT shall be possible to configure the parameter BeamAppTime differnet for different SCS
* FFS if parameter BeamAppTime is under the cell group config.
* Implement acc to RAN1 decisions wrt TCI state for PDCCH, applyunifiedtcistate applied to CORESET, introduce editor’s note about the potential issue (maybe something need to be captured in RRC, or in L1 TS, or need to move the IE).
* P6: Clarify which parameter is intended, resolve naming confusion, miáy be agreeable
* RAN2 assumes that unified TCI state related parameters for DL and Joint is implemented iin IE PDSCH-Config.
* RAN2 assumes UL TCI state is in UL BWP-Dedicated IE
* RAN2 agrees on Separate TCI state lists for joint/DL and UL in PDSCHConfig and UL BWP, respectively, and separate Id pools.
* RAN2 continues discussing MAC CE design for joint and separate TCI state operation as well as the UL/DL BWP association
* FFS if R2 need to select or whether both is applicable: The PO set(P0, alpha, closed loop index) is encoded in both UL TCI state as well in BWP-UL-Dedicated (that is outside of UL TCI state) and different values are enabled for each UL channel PUSCH, PUCCH, SRS. UE receives the UL pc configuration in either UL TCI states or in BWP UL-dedicated. Can maybe ask R1.
* FFS if pathlossRS is configured in UL TCI state which are configured in BWP-UL-Dedicated
* add a new IE for power control for mTRP FR1 operation and consult on the number of power control sets to be configured.
* Add second sri-PUSCH-MappingToAddModList, and select two SRI-PUSCH-PowerControl from two sri-PUSCH-MappingToAddModList
* RAN2 will ask in the LS that whether the per CORESET indications of followunifiedTCIstate of PDSCH is according to RAN1 intention and whether any limitation or condition needs to specified. FFS on exact question formulation as well as if broader question on functionality is added. Work on the FFS when formulating the questions in a draftLS.
* RAN2 will ask in the LS that about implementation suggestion for ApplyTCI-State-r17-DLList. Starting point:“RAN2 notes there is discrepancy with the description and comment related to ApplyTCI-State-r17-DLList. RAN2 has baseline implementation for this functionality where 1 bit “followunifiedTCIstateof PDSCH” is added in “AssociatedReportConfigInfo” where QCL for an aperiodic resource is currently configured. RAN2 would like to ask whether this implementation is according to intended functionality or whether this indication should be placed per NZP-CSI-RS resource. Note that it will be RAN2 signaling design whether supporting this functionality is 1 bit indication per field X, or by maintaining lists of field X.”
* A parameter “followUnifiedTCIstate-r17” is added to SRSResourceSet IE and RAN2 asks RAN1 whether the stated restrictions are enough and whether those should be placed in TS 38.331 or these will be specified by RAN1. FFS if the parameter can be later replaced by other ASN1 ways to indicate the same or exact parameter name. Can also ask more generally intention about SRS resource set
* Ask RAN1 about further input on how the 2 CBSR and RI restrictions are suppose to be config ured. FFS on exact question formulation that can be worked with the draftLS
* Ask RAN1 whether the parameter startPosition should be there in resourceMapping also Rel-17 as it is there in Rel15 and Rel 16.

**MPE:**

* Request the following further information from RAN1: A) How many resources (i.e. SSBRI/CRI ) can be configured in mpe-ResourcePool, and whether the resources are per BWP? B) For mTRP, does UE indicate CORESET pool ID, SRS resource set ID or something else in the mTRP PHR? C) Is the PCMax,f,c needed, and if yes is it included per indicated SSBRI/CRI value, or is it cell-specific?

**SI:**

* Allow NW to update UE SI information either via dedicated configuration, or via switching UE to pTRP for SI reception. FFS if these require specification modifications and whether there are critical issues with the mechanisms.
* When “beam failure is detected on both TRPs” of SCell, TRP specific BFR for both the failed TRPs remains as pending. TRP specific BFR cancellation procedure is applied for each TRP independently.
* Triggered BFRs for a BFD-RS set of a SpCell shall be cancelled when a MAC PDU is transmitted and this PDU includes enhanced BFR MAC CE (or Truncated enhanced BFR MAC CE, if supported) which contains beam failure recovery information (i.e. candidate beam available or not, candidate beam if available) of that BFD-RS set of the SpCell.
* Beam failure is detected on both TRPs” means that BFR is triggered for a TRP of the serving cell while the BFR for another TRP of same serving cell is not successfully completed
* One SR configuration is associated with one PUCCH-SR resource. Up to two SR configurations are signaled for multi TRP BFR i.e. up to two *schedulingRequestId* for multi TRP BFR are included in *MAC-CellGroupConfig*.
* [060] “Enhanced TCI state indication for UE-specific PDCCH MAC CE” can be applied for simultaneously activating two TCI states for a set of serving cells defined by legacy R16 parameters *simultaneousTCI-UpdateList1* and *simultaneousTCI-UpdateList2*.
* [060] Send LS to RAN1 to ask whether the “Enhanced TCI state indication for UE specific PDCCH MAC CE” can be applied to CORESET zero or not.
* [060] “Enhanced TCI state indication for UE specific PDCCH MAC CE” is not applicable to any of the configured CORESETs in a BWP if the CORESETs are configured with different *CORESETPoolindex* values in the BWP.
* [060] “Enhanced TCI state indication for UE specific PDCCH MAC CE” is applied only if *sfnSchemePdcch* is configured.
* [060] If the PDCCH reception includes two PDCCH candidates from corresponding search space sets, start or restart *drx-InactivityTimer* for this DRX group in the first symbol after the end of the PDCCH candidate that ends later in time. FFS how to capture this agreement in the TS 38.321 whether adding it as a NOTE or adding it in the normative text.
* [060] FFS whether to clarify the Active Time when the PDCCH repletion is configured.
* [060] Introduce the new PUCCH spatial relation activation/deactivation MAC CE for mTRP PUCCH repetition i.e. activating two spatial relation info’s (for FR2) for a group of PUCCH resources in a CC.
* [060] Introduce the new MAC CE(s) to support PUCCH Power control set update (with power control) for FR1 cases. FFS, detail MAC CE design based on new RRC IE for FR1-dedicated power control set.
* [060] To revise the legacy PUSCH Pathloss Reference RS Update MAC CE with additional field(s) to differentiate the TRP for mTRP PUSCH repetition, replace the Reserve bit (‘R’) to a TRP index field (‘T’) so that the MAC CE can indicate which TRP the PUSCH pathloss reference RS update can apply for.
* [060] For the enhancement BFR MAC CE design, it is FFS with:

• Two sets of serving cell bitmap (Option 2)

• A bitmap in addition to serving cell bitmap (Option 3)

* [060] FFS whether to support TRP level truncation.
* [060] MAC entity may stop, ongoing Random Access procedure due to a pending SR for BFR of a BFD-RS set of an SCell, which has no valid PUCCH resources configured, if a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU contains an Enhanced BFR MAC CE or a Truncated Enhanced BFR MAC CE which includes beam failure recovery information of that BFD-RS set of the SCell.
* [060] FFS, MAC entity may stop, ongoing Random Access procedure due to a pending SR for BFR of a BFD-RS set of SpCell, which has no valid PUCCH resources configured, if a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU contains an Enhanced BFR MAC CE or a Truncated Enhanced BFR MAC CE which includes beam failure recovery information of that BFD-RS set of the SpCell
* [060] When the MAC entity has pending SR for beam failure recovery of a BFD-RS set and the MAC entity has one or more PUCCH resources overlapping with PUCCH resource for beam failure recovery of that BFD-RS set for the SR transmission occasion, the MAC entity considers only the PUCCH resource for beam failure recovery of that BFD-RS set as valid.

RAN2#117

* P1 is agreed
* Configure UE with two SR IDs, schedulingRequestID-BFR and schedulingRequestID-BFR2, which are associated in an implicit manner in field description to corresponding BFD sets(and align further when BFD set configuration finalizes). FFS whether these IDs are cell group level, cell level or BWP level.
* Add SSB transmission power to SSB-MTC-AdditionalPCI-r17. FFS further modifications based on RAN1 input.
* Configure field SSB-MTC-AdditionalPCI in ServingCellConfig.
* Ask Q to R1 in LS whether for mTRP, additionalPCI is needed for PUCCH-SpatialRelationInfo (or equivalent rephrased question).
* By configuration “both joint TCI and separate DL/UL TCI state” is not supported.
* On Issue 2 (and 3 if question can be finally agreed) we ask RAN1
* RAN2 agree that sfnSchemePdsch in PDSCH-Config is only applicable for BWP-DownlinkDedicated.
* RAN2 confirms that there is no impact to RRM with inter-cell mTRP.
* indicate which TCI mode (joint or separate) should currently be used in a serving cell in the ServingCellConfig. The tci-StateType-r17 parameter should be removed from the current RRC running CR.
* SI reception in inter-cell BM should be covered in TS38.300 (Samsung)

* P1: eLCID is used for Enhanced BFR MAC CE with four octets Ci and truncated Enhanced BFR MAC CE with four octets Ci.
* P2: TRP level truncation is supported.
* P3: MAC entity may stop, ongoing Random Access procedure due to a pending SR for BFR of a BFD-RS set of SpCell, which has no valid PUCCH resources configured, if a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU contains an Enhanced BFR MAC CE or a Truncated Enhanced BFR MAC CE which includes beam failure recovery information of that BFD-RS set of the SpCell.
* P4: The MAC entity shall consider the BFR(s) triggered for a BFD-RS set of a Serving Cell successfully completed (shall not continue) if a PDCCH addressed to C-RNTI indicating uplink grant for a new transmission is received for the HARQ process used for the transmission of the Enhanced BFR MAC CE or Truncated Enhanced BFR MAC CE which contains beam failure recovery information of that BFD-RS set of the Serving Cell.
* P16: Add a NOTE regarding the reference point of starting a DRX inactivity timer when PDCCH repetition is configured.
* P17: Introduce new MAC CE(s) to support PUCCH Power control set update (with power control) for FR1 cases consisting linking of PUCCH resource with one or two PUCCH-PowerControlSetInfos.
* P18: PUCCH power control for mTRP FR1 MAC CE support multiple number of linking between PUCCH Resource ID and PUCCH power control sets.
* P19: PUCCH resource group concept can be also applied to the PUCCH power control for mTRP FR1 MAC CE.
* P20: UL BWP ID which points to the BWP where UL TCI state list is configured is included in unified TCI state activation/deactivation MAC CE.
* P21: The Enhanced PHR MAC CE with two PHs of the same serving cell is introduced for both the single entry format and multiple entry format.
* P22: Both single octet bitmap (7 Ci bits and 1 R bit) and 4 octet bitmap (31 Ci bits and 1 R bit) formats are supported for the Enhanced PHR MAC CE.
* P24: No new TRP specific PHR related parameters are introduced. The legacy PHR related timers and threshold parameters are reused for the enhanced PHR reporting for the mTRP PUSCH repetition case.
* P25: The legacy PHR triggering conditions are reused for supporting enhanced PHR reporting in the mTRP PUSCH repetition case (but triggering condition assumed per TRP instead of per Cell)
* P26: Rel-17 MPE information reporting related issues would be discussed after receiving reply LS from RAN1. R2-2203269 could be the baseline of the further discussion.