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

# 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 | |
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# 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 | |  | |
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**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 BWP  in 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 BWP  in 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. | |
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**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-AssociatedReprotConfigInfo  in 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. | |
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**Conclusion Q1**

TBA

3.4 RRC CR review

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

**Q4: Please indicate further corrections?**

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| --- | --- | --- | --- | --- | --- |
| 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 parameter  TS38.214 5.2.1.4.2  if 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. | |
| 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 | |
| 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.* | |
| 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. | |
| 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.” | |
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**Conclusion Q1**

TBA

# 4 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.