3GPP TSG-RAN WG2 Meeting #118 electronic R2-220

Online, May 9 – 20, 2022

Agenda Item: 6.17.3.1

Source: Ericsson

Title: [AT118-e][076][feMIMO] RRC

Document for: Discussion, Decision

# Introduction

* [AT118-e][076][feMIMO] RRC (Ericsson)

 Scope: 1. Open issues. Take into account progress. Address open issues in submitted tdocs 6.17.3.1 and open RILs. Collect comments, Attempt to converge, identify agreements and discussion points that need online CB. Can take into account incoming LSes when applicable. 2. Progress the RRC CR.

 Intended outcome: 1 Report for CB, 2. Agreed CR (in the end).

 Deadline: for CB W2 Wed,

 Deadline for Companies Comments: Wednesday W2, 03:00 UTC

# Contact Information

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

|  |  |  |
| --- | --- | --- |
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# Status of discussion

RAN2 had two MIMO onlines and reached the below RRC related agreements:

[R2-2205499](file:///C%3A%5CUsers%5Cmtk65284%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CTSGR2_118-e%5CDocs%5CR2-2205499.zip) MIMO ASN1 RIL list Ericsson discussion Late

* Chair asks to confirm the propAgree and propReject statuses (can still discuss details)
* Catt think C619 is proposed reject but is highlighted. Ericsson explains that the high light is just new items added in a revision.
* Vivo wonder about V113 which is prop reject. Ericsson think the status maybe a mistake.
* Confirm the propAgree and propReject statuses, except for V113

See section 10.5 for discussion on V113

[R2-2205916](file:///C%3A%5CUsers%5Cmtk65284%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CTSGR2_118-e%5CDocs%5CR2-2205916.zip) [H060] Inter-cell beam measurement configuration Huawei, HiSilicon discussion Rel-17 NR\_feMIMO-Core Late

* TP is agreed (to be merged into the CR)

This is merged into RRC CR for feMIMO.

* RAN2 assumes (for now) that Rel17 DC (Rel-17 DC is mainly SCG deactivation) and feMIMO may be configured at the same time (can revisit if issues are found).

Based on the above RILs F001 anf F002 are closed from MIMO WI pesrpective and if any changes it is via DCCA WI.

RAN2 has received a new LS from RAN1:

R2-2206359  LS response on feMIMO RRC parameters (R1-2205168; contact: Samsung)

<https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_118-e/LSin/R2-2206359.zip>

These responses apart from BFD(BFR are handled in this discussion.

RAN2 has received a new LS from RAN1:

R2-2206438         LS response on TCI state signalling for SRS resource (R1-2205247; contact: OPPO)

Further, we continue on other remaining issues.

# Unified TCI state for SRS-resource

This is a reply LS to RAN2 to address the RAN2 questions on TCI state signalling for SRS resource in R2-2206356.

**2. Questions and answers**

**Question 1:**

For using unified TCI states with SRS resources, are there cases that are not addressed by current RRC specification (v17.0.0) and would require something to be specified in RAN2 (i.e., new RRC parameter or MAC CE based signalling)?

**Answer 1**:

The current RRC specifications covers the following case:

* SRS resource configured to follow the unified TCI state. This can be (1) aperiodic SRS for BM (2) Any time domain behaviour of SRS for CB/NCB/Ant Switching

***followUnifiedTCIstateSRS***

When set to enabled, for SRS resource Set, the UE applies the "indicated" Rel-17 DL only or joint TCI 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.

The following cases are not covered by current RRC specification:

* SRS resource not configured to follow the unified TCI state. The Rel-17 TCI state can be indicated by: (1) RRC configuration for periodic SRS (2) MAC CE for AP-SRS and SP-SRS
* P/SP-SRS for beam management. These don’t follow the unified TCI state. The Rel-17 TCI state can be indicated by: (1) RRC configuration for periodic SRS (2) MAC CE for SP-SRS

This follows the following RAN1 agreements:

**Agreement RAN1#106-e**

On Rel.17 unified TCI framework:

* Aperiodic SRS resources or resource sets for BM can share the same indicated Rel-17 TCI state as dynamic-grant/configured-grant based PUSCH, all or subset of dedicated PUCCH resources in a CC
	+ FFS: Discuss if/which restriction is necessary, e.g. only for aperiodic, apply to all resources in a set
	+ Note: This doesn’t imply that all time-domain behaviors are automatically supported

**Agreement RAN1#106b-e**

On Rel.17 unified TCI framework, for Rel-17 unified TCI, for DL or UL channels/signals that can share the same indicated Rel-17 TCI state as UE-dedicated reception on PDSCH/PDCCH or dynamic-grant/configured-grant based PUSCH, all of dedicated PUCCH resources (via Rel-17 MAC-CE/DCI TCI state update):

* For DL: A non-UE dedicated PDCCH/PDSCH associated with the serving cell PCI or AP CSI-RS for BM or CSI (per previous agreements) sharing the same indicated Rel-17 TCI state as UE-dedicated reception on PDSCH/PDCCH (via Rel-17 MAC-CE/DCI TCI state update) is configured via RRC.
* For UL: An SRS for BM, for antenna switching, or for codebook/non-codebook based uplink transmission (per previous agreements) sharing the same indicated Rel-17 TCI state as dynamic-grant/configured-grant based PUSCH, all of dedicated PUCCH resources (via Rel-17 MAC-CE/DCI TCI state update) is configured via RRC.

Note: The details of this RRC configuration (e.g. whether via a new RRC parameter or other means) is up to RAN2. This does not imply that a new RRC parameter(s) is necessary from RAN1 point of view.

FFS: Relevant UE capability to be discussed under UE feature agenda item.

A possible implementation would be to include the field

 tciState-r17 CHOICE {

 tci-StateUnifiedId-r17 TCI-StateId,

 ul-TCIState-Id-r17 UL-TCIState-Id-r17

}

in the SRS-Resource IE, when the SRS resource is a periodic SRS that is not configured or cannot follow the unified TCI state.

**Question 1.** **Do you agree to implementa according to the LS response?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/no | Comment or RRC implementation suggestion |
| OPPO | Yes | the IE name could be changed to be tciStateId-r17 |
| Ericsson | Seems to give static configuration and wonder how the MAC CE would then work. | Should be list but RAN2 does not have e.g. info on max value of resources to be configured. Unsure what Ran2 should do here. |
| Xiaomi |  | Agree with Ericsson that the above RRC signaling seems not able to support the corresponding MAC CE. |
| Huawei, HiSililcon | Partially | For the **first choice value, we also need a DL BWP ID and for the second choice value, we also need an UL BW**P ID.To Ericsson's questions: we agree this only supports the static case. |
| Apple | Yes |  Agree with OPPO that the IE name needs to be updated. 1. For the periodic SRS, new IE “tciState-r17” is added in *SRS-Resource*,
2. For the AP-SRS and SP-SRS, the TCI state is indicated via the new SRS TCI indication MAC CE.
 |
| Samsung |  | Agree with Ericsson and Huawei. Some further remarks on the detail signaling:* Optional Need code is needed, suggest Need R
* Fields in CHOICE structure don’t need the suffix “-r17”, remove the suffix “-r17” for tci-StateUnifiedId-r17 and ul-TCIState-Id-r17
 |

# Pathloss reference ID

RAN2 asked about maximum RRC configured pathloss reference RS for BM and for PUCCH mTRP and received the below response:

**Issue 1: Pathloss Reference RS for BM and PUCCH mTRP**

pathlossReferenceRS-Id-r17 was used originally for DLorJoint-TCIState-r17 and PUCCH-PowerControlSetInfo-r17 separately but changed to PUCCH-PathlossReferenceRS-Id/PUSCH-PathlossReferenceRS-Id due to RRC consistency issues. In order to finalize these parameters, it is necessary to know what the maximum number of pathloss Reference RSs is for BM and PUCCH mTRP respectively. In particular, for the unified TCI state, RAN1 agreement "Total of maintained PL-RS per CC is up to 4" is not clear: Does this refer to the maximum amount of configured PL-RS per serving cell? Or what does “maintained” mean in context of RRC configuration?

**Question 1:** What does the RAN1 "Total of maintained PL-RS per CC is up to 4" mean for signalling of PL-RS? Is it relevant for RRC/MAC specification? Please clearly express what is the maximum number of RRC configured Pathloss RS set for 1) unified TCI state and 2) PUCCH power control set?

**Answer 1**: “Total of maintained PL-RS per CC is up to 4” is only related to PL-RS measurement associated with activated UL or, if applicable, joint TCI states. It is irrelevant to RRC specification.

The maximum number of RRC-configured PL-RS for unified TCI state is 64 (the same as the maximum number of RRC-configured UL TCI states).

The maximum number of RRC-configured PL-RS for PUCCH PC set (multi-TRP PUCCH operation) in FR1 is 8.

As outcome, for PUSCH-PathlossReferenceRS a new r17 ID space is created and this is used in IE DLorJoint-TCIState and in IE UL-TCIState. For PUCCH-PathlossReferenceRS in IE PUCCH-PowerControl the PUCCH-PathlossReferenceRS-Id-v1610 is used. Please review the implemtation in the RRC CR Corrections for feMIMO provided in the draft folder.

**Question 1.** **Please review the implemtation in the RRC CR Corrections for feMIMO provided in the draft folder and provide revision suggestion if needed.**

|  |  |  |
| --- | --- | --- |
| Company | 1. Agree the CR implementation
 | 1. Give here revision if such is needed
 |
| OPPO | Yes for the new ID for PUSCH-PathlossReferenceRS, No for PUCCH-PathlossReferenceRS-Id-v1610 | RAN1 LS response that ” The maximum number of RRC-configured PL-RS for PUCCH PC set (multi-TRP PUCCH operation) in FR1 is 8”. but PUCCH-PathlossReferenceRS-Id-v1610 is up to 63. Reusing is also feasible with 1 bit more signaling overhead. Clean alternative is to introduce a new ID with 3 bits. |
| Ericsson | yes | Even the ID space for PUCCH-PathlossReferenceRS-Id-v1610 is up to 63, the number of PUCCH-PowerControlSetInfo that can be given to the UE is 8 so it is enough that ID space is more than 8.PUCCH-PowerControlSetInfo-r17 ::= SEQUENCE { pucch-PowerControlSetInfoId-r17 PUCCH-PowerControlSetInfoId-r17, p0-PUCCH-Id-r17 P0-PUCCH-Id, pucch-ClosedLoopIndex-r17 ENUMERATED { i0, i1 }, pucch-PathlossReferenceRS-Id-r17 PUCCH-PathlossReferenceRS-Id-v1610  --Editor's note: to be aligned with the corresponding MAC CE design} |
| Xiaomi | Yes |  |
| Huawei, HiSilicon | See comments | (1) Currently, the PUSCH-PathlossReferenceRS-Id-r17 is used in TCI State but defined in PUSCH-PowerControl. So PUSCH-PathlossReferenceRS-Id-r17 should be promoted to an IE. Moreover, since this isn't only used for PUSCH, it would make sense to change the name.(2) Regarding PUCCH-PathlossReferenceRS, we have PUCCH-PathlossReferenceRS-Id-v1610 ::= INTEGER (maxNrofPUCCH-PathlossReferenceRSs..maxNrofPUCCH-PathlossReferenceRSs-1-r16)This is from 4 to 63, so it can't be used for 0 to 7. |
| Apple | Yes | Agree with Huawei’s comments.  |
| Samsung |  | Same view with OPPO and Huawei, Need to correct the using the PUCCH-PathlossReferenceRS-Id-v1610. It seems better to introduce the new ID with 3bits for Rel-17. |

# sfnScheme E011, V108, V107

RAN2 asked about snfScheme configuration and received the below response:

**Issue 2: sfnScheme-r17 and sfnSchemePdsch-r17 in HST**

RAN1 indicates sfnScheme-r17 and sfnSchemePdsch-r17 as per BWP. However, there is a note that “In Rel-17, all downlink BWPs (except initial BWP and FFS: BWP-DownlinkCommon) within a CC should have the same configuration of SFN scheme”. In addition, it is not clear whether PDSCH and PDCCH can have different SFN schemes in the same serving cell?

**Question 2:** RAN2 has currently defined sfnScheme-r17 as part of PDCCH-Config and sfnSchemePdsch-r17 as part of PDSCH-Config, which are per BWP. But since the values are the same for all BWPs, a more efficient signalling would be to define them per serving cell. Is there a reason why the configuration needs to be per BWP?

**Answer 2**: In accordance to RAN1 agreements, the configuration of SFN scheme is per BWP. The restriction (same value for all BWPs) can be captured in 38.331.

**Question 3:** Can PDSCH and PDCCH use different SFN schemes in the same serving cell, e.g. can PDCCH use sfnSchemeA and PDSCH sfnSchemeB for the same BWP?

**Answer 3**: Per RAN1 agreement, it cannot.

Based on the response, sfnScheme shall have same value for PDSCH and PDCCH in same BWP. Additionally, same value for all BWPs shall be configured in a serving cell.

Consequence the correct placement for these parameters is in IE ServingCellConfig instead on BWP level. Parameters are moved to IE MIMOParam in IE ServingCellConfig. Note that UE can be configured for snfScheme for one of PDCCH, PDSCH or both hence two parameters are needed.

Status of related RILs E011, I113, V107 and V108 is changed to Prop Reject as these have become outdated given the above change.

**Question 2.** **Please review the implemtation in the RRC CR Corrections for feMIMO provided in the draft folder and provide revision suggestion if needed.**

|  |  |  |
| --- | --- | --- |
| Company | 1. Agree the CR implementation
 | 1. Give here revision if such is needed
 |
| OPPO | Yes |  |
| Ericsson | yes |  |
| Xiaomi | Yes |  |
| Huawei, HiSilicon |  | RAN1 indicated that the SFN schemes are the same for PDSCH and PDCCH, but there are two independent parameters in the draft CR.If SFN is always used for PDCCH when it is used for PDSCH and vice versa, a single parameter would make more sense. Otherwise, we can have 2 parameters but should capture the restriction.  |
| Apple | Yes | We can capture the restriction on the SFN schemes configuration for PDSCH and PDCCH in the field description. |
| Samsung | Yes | Since RAN1 clearly indicated to configure two separate configuration with restrictions we can follow this. Maybe it can be a future proof way i.e. remove the restrictions in the future release?? |

# Codebookconfig V109, I115, V112,

RAN2 asked about RI restrictions and CBSR configuration and received the below response:

**Issue 3: CSI-mTRP**

RAN2 introduced 2 types of RI restrictions and two codebook subset restrictions (CBSR) per CodebookConfig. However, it is not clear how those features are enabled: Currently, same as in previous releases, RAN2 signalling assumes both RI restrictions and CBSR are configured simultaneously, but RAN2 would like to verify this is the correct assumption for the signallling.

**Question 4:** Which of the following assumptions are correct?

* If two RI restrictions are configured, two CBSRs are configured and if two CBSRs are configured two CBSRs are configured (i.e. when two are configured for either RI restriction or CBSR, two are also configured for the other).
* UE can be configured with either RI restriction for sTRP or RI restriction for NCJT, but not both at the same time.
* If two CBSRs are configured, two CMR groups are configured and if two CMR groups are configured, two CBSRs are configured (i.e. when two are configured for either CBSR or CMR groups, two are also configured for the other and there cannot be configuration of e.g. one CBSR but two CMR groups)

**Answer 4**:

* Regarding Assumption 1, RI restriction and CBSR are two independent features
	+ RAN1 may provide further details later, if needed
* Assumption 2 is incorrect.
	+ UE is configured with one RI restriction for NCJT if csi-ReportMode-r17 is set to ‘Mode1’ and numberOfSingleTRP-CSI-Mode1-r17 is set to ‘n0’, otherwise UE is configured with two RI restrictions for sTRP and NCJT respectively.
* Assumption 3 is correct

Based on the response for Assumption 1, it seems no change is needed for the existing implementation. For Assumption 2, the given restriction is specified in TS 38214:

- The *CodebookConfig* in *CSI-ReportConfig* can be configured with two RI restriction parameters. One parameter applies to a reported RI when conditioned on a CRI corresponding to an entry of the $M$ CSI-RS resources defined above. Another parameter applies to a reported joint RI index when conditioned on a CRI corresponding to an entry of the $N$ Resource Pairs and indicates one or more of the four rank combinations that are allowed to correspond to the reported PMIs and RIs.

- The *CodebookConfig* in *CSI-ReportConfig* can be configured with two Codebook Subset Restrictions. The first restriction applies to a reported PMI associated to a CSI-RS resource in Group 1. The second restriction applies to a reported PMI associated to a CSI-RS resource in Group 2.

Hence it seems to be sufficient to refer to that specification, which is already existing in the RRC CR.

For Assumption 3, no functional change is needed but slight revision for field description typeI-SinglePanel1, typeI-SinglePanel2 is suggested.

RILS I105 and V112 are related to codebook config and are suggested to be agreed. That is, to move numberOfPMI-SubbandsPerCQI-Subband-r17 to the IE of CodebookConfig-r17 under type2 as this seems to be a type2 specific parameter.

RILV109 is also related to codebookconfig:

The name of typeI-SinglePanel1 and typeI-SinglePanel2 may have misunderstanding that there are two panels in this case. Actually, the codebook for CSI calculation is configured when UE is configured with two CMR groups in the NZP-CSI-RS-ResourceSet associated with the CSI-ReportConfig. Thus, the proposed change is: Change the name of “typeI-SinglePanel1” and “typeI-SinglePanel2”to “typeI-SinglePanel-CMRGroup1” and “typeI-SinglePanel-CMRGroup2”, respectively.

The field description is slighly reworded and parameter names are changed to typeI-SinglePanel-Groupx.

Status of the RILs I105, V112 and V109 is changed to PropAgree.

**Question 3.** **Please review the implemtation in the RRC CR Corrections for feMIMO provided in the draft folder and provide revision suggestion if needed.**

|  |  |  |
| --- | --- | --- |
| Company | 1. Agree the CR implementation
 | 1. Give here revision if such is needed
 |
| OPPO | Yes but | Slightly prefer the wording of the IE name from RILV109 i.e. typeI-SinglePanel-CMRGroup1/2 |
| Ericsson | yes | If majority support on longer name, it can be adopted |
| Xiaomi | Yes |  |
| Samsung | Yes |  |
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# PUSCH repetition and SRS resource sets

RAN2 asked about PUSCH repetition and received the below response:

**Issue 4:**

There are several parameters to support mTRP PUSCH (i.e. PUSCH repetition). RAN2 configuration assumes those parameters are only configured when two SRS resource sets are configured and the *usage in SRS-Config* is set to *codebook* or *noncodebook*. However, it is not clear the what "two SRS resource sets" means since in Rel-15/16 up to SRS resource sets can be configured and there are separate lists of SRS resource sets for DCI formats 0\_1 and 0\_2, as shown below. RAN2 would need to know this to set the configuration constraints correctly.

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

    srs-ResourceSetToAddModListDCI-0-2-r16  SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceSet          OPTIONAL, -- Need N

**Question 5:** When mTRP PUSCH repetition is used, what is the definition of "two SRS resource sets" being used? Can those be SRS resource sets as in the Rel-15/16 configuration, or are those only configured with Rel-17 fields?

**Answer 5**: When “two SRS resource sets” are configured in one of the following settings, the Rel-17 mTRP PUSCH repetition can be applied:

- Two SRS resource sets in srs-ResourceSetToAddModList with usage = ‘codebook’

- Two SRS resource sets in srs-ResourceSetToAddModList with usage = ‘nonCodebook’

- Two SRS resource sets in srs-ResourceSetToAddModList-0-2 with usage = ‘codebook’

- Two SRS resource sets in srs-ResourceSetToAddModList-0-2 with usage = ‘nonCodebook’

In Rel-15/16, only up to one SRS resource set can be configured in each of the above four settings.

Based on the response the field description condition in various places in RRC is updated to:

two SRS resource sets are configured in srs-ResourceSetToAddModList or srs-ResourceSetToAddModList 0-2 with usage ‘codebook’ or ‘noncodebook’

Further the yellow highlited is added:

***sequenceOffsetForRV***

Configures the RV offset for the starting RV for the first repetition (first actual repetition in PUSCH repetition Type B) towards the second 'SRS resource set' for PUSCH configured in either srs-ResourceSetToAddModList or srs-ResourceSetToAddModList 0-2 with usage ‘codebook’ or ‘noncodebook’.

**Question 4.** **Please review the implemtation in the RRC CR Corrections for feMIMO provided in the draft folder and provide revision suggestion if needed.**

|  |  |  |
| --- | --- | --- |
| Company | 1. Agree the CR implementation
 | 1. Give here revision if such is needed
 |
| OPPO | agree |  |
| Ericsson | agree |  |
| Xiaomi | agree |  |
| Huawei, HiSilicon | agree |  |
| Samsung | agree | There are no srs-ResourceSetToAddModList0-2, it should be srs-ResourceSetToAddModListDCI-0-2. Please update the RRC CR accordingly. |
|  |  |  |

# ul-powerControl

RAN2 asked about UL power control and received the below response:

**Issue 5:**

The Rel-17 parameter *ul-powerControl-r17* configures power control parameters for PUCCH, PUSCH and SRS when UE is configured with unified TCI state. Current RRC enables the configuration in a dedicated UL BWP and also in configured unified TCI states that contains UL (i.e. joint or UL TCI state). Hence the current field description states:

***ul-powerControl***

Configures power control parameters for PUCCH, PUSCH and SRS when UE is configured with unifiedtci-StateType .The field is present here only if UL power control is not configured for any UL TCI state and DLorJoint-TCIState.

However, as it is understood that UE can be configured only with unified TCI state or Rel-15/16 TCI state framework, it is not clear if can be configured with Rel-15/16 power control parameters when UE is configured with parameter *ul-powerControl-r17*.

**Question 6:** Is the UE always configured with parameter *ul-powerControl-r17* when the UE is configured with unified TCI states? If yes, will the UE use a Rel-15/16 UL power control configuration when the UE is configured with unified TCI states?

**Answer 6**: Yes, the UE is always configured with parameter ul-powerControl-r17 in BWP-UplinkDedicated or, optionally, in DLorJointTCIState/UL-TCIState. In this case, the UE will not use a Rel-15/16 UL PC configuration.

Based on the response, the FFS from below field description is deleted:

***ul-powerControl***

Configures power control parameters for PUCCH, PUSCH and SRS when UE is configured with unifiedtci-StateType .The field is present here only if UL power control is not configured for any UL TCI state and DLorJoint-TCIState. ~~FFS:~~ When network includes this field either here or in any UL TCI state or DLorJoint-TCIState, the network does not configure the UE with corresponding power control parameters with PUCCH-PowerControl, PUSCH-PowerControl or SRS-Config.

**Question 5.** **Please review the implemtation in the RRC CR Corrections for feMIMO provided in the draft folder and provide revision suggestion if needed.**

|  |  |  |
| --- | --- | --- |
| Company | 1. Agree the CR implementation
 | 1. Give here revision if such is needed
 |
| OPPO | Agree |  |
| Ericsson | agree |  |
| Xiaomi | Agree |  |
| Huawei, HiSilicon |  | The sentences in the field descriptions are rather fuzzy:1) The field is present here only if UL power control is not configured for any UL TCI state and DLorJoint-TCIState.This is unclear, that should be if ul-powerControl is not configured, i.e. refer to a field not "UL power control" in general.2) When network includes this field either here or in any UL TCI state or DLorJoint-TCIState, the network does not configure the UE with corresponding power control parameters with PUCCH-PowerControl, PUSCH-PowerControl or SRS-Config.a) the restriction about ul-PowerControl in UL TCI state or DLorJoint-TCIState needs not be captured in BWP-UplinkDedicatedb) it is unclear which are the "corresponding power control parameters" (i.e. which one "correspond" and which ones don't), this should rather be captured in each relevant field description in PUCCH-PowerControl, PUSCH-PowerControl and SRS-Config, and that sentence should be removed from here. |
| Aooke | Yes |  |
| Samsung |  | I tend to agree with Huawei, the current description is somewhat not clear. |

# MPE needs discussion RRC MAC, I116

The MPE RRC configuration and MAC CE operation is discussed in:

R2-2204598 M Discussion open RRC issues on MPE report and BFR OPPO

R2-2204820 M Discussion on MPE for ICBM vivo

R2-2205414 M Further Consideration on [RILZ095] for Enhanced MPE ZTE Corporation,Sanechips

R2-2205789 M Discussion on [I115], [I116, Z095], [I102] Intel Corporation

R2-2205920 M [Z095][I116] MPE RRC configuration Huawei, HiSilicon

RAN2 sent in an LS the following question:

**Issue 6: MPE reporting in ICBM (inter-cell beam management):**

RAN2 has currently defined MPE resource pool as only using serving cell SSB/CSI-RS indexes. However, it was not clear if the MPE resource pool should also allow indicating SSB/CSI-RS indexes for the additional PCI so RAN2 would like to verify that.

**Question 7:** In one MPE resource pool, can a MPE resource containing SSBRI/CRI be associated with an additional PCI?

**Answer 7**: Yes, with the following clarification (exact details are up to RAN2)

* For SSB, an “additional PCI” can be added in MPE-Resource-r17 (hence conditioned on choosing SSB for mpe-ReferenceSignal-r17).
* For NZP CSI-RS, since each NZP CSI-RS resource is associated with a TCI state (which already includes a PCI), no “additional PCI” needs to be added in MPE-Resource-r17
* Note: Depending on the outcome of UE capability discussion, this can be subject to UE capability

There are also related RILs Z095 and I116 that say MPE-ResourcePool should be configured per BWP

**Question 6.** **Please give your view whether you think MPE resourcePool needs to be configured per BWP. If so give your suggetsion for the revisison**

|  |  |  |
| --- | --- | --- |
| Company | 1. Yes/no
 | 1. Spec impact
 |
| OPPO | Comments | We think two changes are necessary regardless of the graualrity of the configuration:1, additional PCI per resource for ssb-Resource-r172, a list of resource is easily assocaited with a serving cell for better interpretation of corresponoding MAC CEAs for configuration granualrity, we think there are two alternatives:1, keep in current place but change it to be per cell lists2, configuration per BWPThere is a UE capability to define maimum number of resource either per cell or per cell group (not decided yet so far). The benefit of alt1 is that it is easier to configure based on UE capability in case the UE capability is per cell group. In addition MPE resource would be configured together with other relevant parameters. So we slightly prefer to keep it current place and change the resource pool as few lists of resource, where each resource is associated with one serving cell. |
| Ericsson | comments | The list in Option 1 would be preferred. However, are we able to know how many of such lists and how many resources per list? |
|  |  |  |
|  |  |  |
|  |  |  |

# Other

## V101

**[RIL]**: V101 **[Delegate]**: vivo-Chenli **[WI]**: feMIMO **[Class]**: 2 **[Status]**: ToDo **[TDoc]**: None **[Proposed Conclusion]**: v32

**[Description]**: whether qcl-info for aperiodic CSI-RS follows indicated TCI state should be configured by RRC

**[Proposed Change]**:

The RAN1 conclusion is whether aperiodic CSI-RS for BM/for CSI should follow indicated TCI state should be configured by RRC. But the current description indicates that “When this field is absent for aperiodic CSI RS,” then, the QCL info will follow indicated TCI state. It is not aligned with RAN1 conclusion. Besides, this implicit indication would not be appropriate for future proof.

Thus, the proposed solution is to add an explicit indication whether follow the indicated TCI state as the indication for CORESET part:

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

The current specification has the *qcl-info* is optional Need R in case of periodic resources for serving cells configured with unifiedtci-StateType. If we add the requested parameter it adds unnecessary parameter with need to spevify that UE ignores another parameter. Hence we propose to reject the RIL and keep the specification as it is.

1. RAN2 to agree on PropReject on RIL V101

**Question 7.** **Please give view if Proposal 1 is acceptable.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/no | comments |
| OPPO | No | We think current spec works, but also intend to agree with vivo that current spec is not clear as such that the message is hiden in the absence of the *qcl-info*. Since both *qcl-info* and *followUnifiedTCIstateSRS-r17* are optional and their presence is exclusive, there should be no issue to ignore any configuration. |
| Ericsson | yes | As it is an optional parameter that would then be ignored. However, we can go with majority view. |
| Xiaomi | Yes |  |
| Huawei, HiSilicon | Yes | With respect to OPPO's comment: we disagree with "there should be no issue to ignore any configuration.". The qcl-Info is optional so if the network wants the UE not to use it, it makes no sense to actually send it.About the comments:- Absence of qcl-Info is "configured by RRC" so this is perfectly aligned with RAN1 conclusion.- If we would add a parameter, we would have to add that the network always includes it if qcl-Info is configured for AP CS-RS and never includes it otherwise. This adds complexity for no gain.About being "future proof": if a parameter is needed later, there is no issue to add it later.We can accept a parameter if majority wants it, but we must capture the restriction mentioned above then. |
| Samsung | Yes |  |
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## H102

It is suggested to make improvement in the code by replacing IE PUCCH-SRS with SRS-uplinkBWP-id

R2-2205922 M [H102] Replace PUCCH-SRS with IE Huawei, HiSilicon

Proposal 1: Create a new IE called SRS-uplinkBWP-Id, which has the same content with PUCCH-SRS.

There is no functional change and code is improved, hence RIL H0102 is implemented, and status changed to Prop agree.

**Question 8.** **Please review the implemtation in the RRC CR Corrections for feMIMO provided in the draft folder and provide revision suggestion if needed.**

|  |  |  |
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| Company | 1. Agree the CR implementation
 | 1. Give here revision if such is needed
 |
| OPPO | Not really | The reason behind is the misleading of the IE name. But the proposed IE name sounds like it is a BWP id only i.e. still misleading too. Maybe we can rename the IE in general way as such that it is not linked to any specific channel |
| Ericsson | yes | To Oppo: Do you agree with the intention and only comment is about naming? If so, are you able to provide better name? Note that the IE is about giving SRS resource so I’m not suren what is the issue of reflecting that in the name. What about SRS-UplinkBWP? I think the intentiom behonmd the TP is also about that unified TCI state framework was referring to an IE PUCCH-SpatialRelationInfo that was definied in an IE of Rel-15/16 TCI state, and there is understanding that UE is configured with one of these only. I stronly support that it is made a separate IE but name can be fine tuned. |
| Xiaomi | Yes |  |
| Huawei, HiSilicon | Yes | Ok to fine tune the name. |
| Samsung | Yes |  |
|  |  |  |

## H059 (Z100)

R2-2205915 M [H059] Channel measurement resource configuration for mTRP Huawei, HiSilicon

Proposal 1: Specify in the field description of nzp-CSI-RS-ResourceSetList and of csi-SSB-ResourceSetList that when R17 group-based beam reporting is configured in the CSI-ReportConfig in which the CSI-ResourceConfig is indicated as resourceForChannelMeasurements, there are two resource sets, which could be 2 NZP CSI-RS resource sets, two CSI-SSB resource sets or one of each, and indicate which resource set corresponds to value 0 or 1 of the resource set indicator in TS 38.212 table 6.3.1.1.2-8B

R2-2204599 M Discussion on RILs:F001, F002, V101,V102,H059,H060, I105,V112,V109,I115,Z095 OPPO

Proposal 8: the order of CMR resource for periodic and SPS CSI reporting set refers to the their appearance order in the IE CSI-ResourceConfig

R2-2205915 inlcudes a TP to clarify the order of CMR resources which seems correct. Additionally the TP contains small change for groupBasedBeamReporting which has also been brought up in Z100(marked as PropoReject). Even thought this change is not really needed it is also clear in the TP so it is not a problem to adopt it.

Hence, TP in R2-2205915 is implemented and status for RILs H059 and Z100 is changed to Prop agree.

**Question 9.** **Please review the implemtation in the RRC CR Corrections for feMIMO provided in the draft folder and provide revision suggestion if needed.**

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| --- | --- | --- |
| Company | 1. Agree the CR implementation
 | 1. Give here revision if such is needed
 |
| OPPO | Agree in general | There is one sentence in the field descriptioin of *csi-SSB-ResourceSetList:*“*if the list has one CSI-SSB resource set, this resource set is indicated by a resource set indicator set to 1;*”First of all 1 should be zero;In addition the meaning of the “ *resource set indicator*” is not clear. Following the context, it is the index of resource set in the list, so maybe wording like “resource set index” is better. This comments could apply for the whole field description and field description of NZP CSI-RS resource. |
| Ericsson | agree |  Using resource ID is probably better. I think it is correct saying 1and 0 the way it does, however maybe not so clear why it is used like that. |
| Xiaomi | Agree |  |
| Huawei, HiSilicon | Agree | "resource set indicator" is from 38.212 just below the quoted table, we prefer to stick to RAN1 specification names exactly. The same sentence also says "1st resource set for channel measurements" and "2nd resource set for channel measurements", so it would also be ok to use that instead.About OPPO's comment: when there are two resources sets, one CSI-SSB and one CSI-RS, one should be identified by 0 and the other by 1. We have put 0 for CSI-RS and 1 for CSI-SSB, so it is correct as of now. (could do the opposite, it does not matter). |
| Samsung | Yes |  |
|  |  |  |

## V102

Condition for resourcesForChannel2 for aperiodic CSI-RS should be updated.

In the field description of resourcesForChannel2, it is stated “If unifiedtci-StateType is configured, this field is absent.”. Thus, there is some conflict with the condition for resourcesForChannel2 for aperiodic CSI-RS as the description for “Aperiodic” includes “and unifiedtci-StateType is configured”. Thus, the proposed solution is to remove the condition “and unifiedtci-StateType is configured” in the explanation of “Aperiodic” Conditional Presence. Aperiodic The field is mandatory present if the NZP-CSI-RS-Resources in the associated resourceSet have the resourceType aperiodic and unifiedtci-StateType is not configured. The field is optional Need R if the NZP-CSI-RS-Resources in the associated resourceSet have the resourceType aperiodic and unifiedtci-StateType is configured.The field is absent otherwise.

#### – *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

 ...,

 [[

 -- Editor's note: It has been suggested to delete this field and add note on qcl field description due to: "The UE shall ignore

 -- qcl-Info" is rather strange since qcl-Info is an optional parameter so, if the network wants the UE to ignore it, what is the point

 -- of including it".

 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-ResourceSetsPerConfigExt)

 } OPTIONAL, -- Need R

 csi-SSB-ResourceSetExt INTEGER (1..maxNrofCSI-SSB-ResourceSetsPerConfigExt) OPTIONAL -- Need R

 ]]

}

-- TAG-CSI-APERIODICTRIGGERSTATELIST-STOP

-- ASN1STOP

|  |
| --- |
| *CSI-AssociatedReportConfigInfo* field descriptions |
| ***ap-CSI-MultiplexingMode***Indicates if the behavior of transmitting aperiodic CSI on the first PUSCH repetitions corresponding to two SRS resource sets configured in srs-ResourceSetToAddModList or srs-ResourceSetToAddModList 0-2 with usage ‘codebook’ or ‘noncodebook’ 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-ResourceSet2***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). |
| ***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, qcl-info2***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). When this field is absent for aperiodic CSI RS, the UE shall use QCL information included in the "indicated" DL only/Joint TCI state as specified in TS 38.214 |
| ***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, network configures csi-SSB-ResourceSetExt instead of csi-SSB-ResourceSet and the UE ignores csi-SSB-ResourceSet in resourcesForChannel, and the *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). If unifiedtci-StateType is configured, this field is absent. |
| ***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 and unifiedtci-StateType is not configured. The field is optional Need R if the *NZP-CSI-RS-Resources* in the associated *resourceSet* have the resourceType aperiodic and unifiedtci-StateType is configured. 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. |

The condition Cond Aperiodic is for qcl-info2-r17 and not for resourcesForChannel2 which is optional Need R.

1. RAN2 to agree on PropReject on RIL V102

**Question 10.** **Please give view if Proposal 2 is acceptable and especially if there is any further revision needed for CSI-AperiodicTriggerStateList.**

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| --- | --- | --- |
| Company | Yes/no | comments |
| OPPO | No | Following current field description of resourcesForChannel2, when unifiedtci-StateType is configured, resourcesForChannel2 will be absent. So logically the qcl-info2-r17 will be absent also. But the it shares the same condition as qcl-info which results in collision. Hence the condition of the qcl-info2-r17 should copy the original description of condition *Aperiodic*, but not the updated one. |
| Ericsson |  | Oppo’s point seems to make sense. |
| Huawei, HiSilicon |  | We should:- restore the condition Aperiodic to its original definition- use a new condition (e.g. Aperiodic2) for qcl-info2-r17 (copied from the new one but with "not" added, see in red):The field is mandatory present if the *NZP-CSI-RS-Resources* in the associated *resourceSet* have the resourceType aperiodic and unifiedtci-StateType is not configured. The field is optional Need R if the *NZP-CSI-RS-Resources* in the associated *resourceSet* have the resourceType aperiodic and unifiedtci-StateType is not configured. The field is absent otherwise. |
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## I115, V113

R2-2205789 M Discussion on [I115], [I116, Z095], [I102] Intel Corporation

R2-2204599 M Discussion on RILs:F001, F002, V101,V102,H059,H060, I105,V112,V109,I115,Z095 OPPO

This item is resolved according to the latest status on discussion on reflector for [Pre118-e][002][feMIMO] 38331 CR and rapporteur resolutions (Ericsson).

Status for RIL V113 is changed to Prop agree.

**Question 11.** **Please review the implemtation in the RRC CR Corrections for feMIMO provided in the draft folder and provide revision suggestion if needed.**

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| --- | --- | --- |
| Company | 1. Agree the CR implementation
 | 1. Give here revision if such is needed for corrections
 |
| OPPO |  | The current implementation suggests that the NZP-CSI-RS-ResourceSet configured CMRGroupingAndPairing-r17 could only have up to 8 nzp-CSI-RS-Resources because nrofResourcesGroup2-r17 is replaced by ” the remaining resources in the NZP-CSI-RS resource set belonging to Group 2”. It would be hard to share the same resource with other purpose. Is it the intention? |
| Ericsson | yes | To Oppo, not sure if I understand the question. Resource can be only in one group. Does this clarify? |
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|  |  |  |
|  |  |  |

# Conclusion

In the previous sections we made the following observations: