3GPP TSG-RAN WG2 Meeting #117 Electronic R2-22xxxx

Elbonia, February 2022

**Agenda item:**

**Source: Ericsson**

**Title: [Pre117-e][009][feMIMO] feMIMO Open Issues Input (Ericsson)**

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

**Document for: Discussion and Decision**

# Introduction

Pre117-e discussions to gather company input on specific Open Issues See also R2-2202001

RRC:

- pucch-PowerControlSet to be aligned with the corresponding MAC CE design, R2 action: develop common understanding on the operation.

- BFD/BFR RRC configuration is not implemented. Rows 60-62, 67. R2 action: develop common understanding on the operation.

- the detail SSB configuration of aTRP, and including whether such IE is also applicable for mTRP (4.1), why put it under SSB-MTC (4.2), wheher there is a disconnect on the application of PUCCH-SpatialRelationInfo (4.4.),

- How to indicate serving cells, which will share common TCI state i.e. share the MAC CE and DCI from one reference serving cell (this issue is also related to the configuration of beamAppTime-r17).

# 2 Contact Points

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

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
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# 3 Discussion

This pre RAN2#117 discussion covers the following items:

- pucch-PowerControlSet to be aligned with the corresponding MAC CE design, R2 action: develop common understanding on the operation.

- BFD/BFR RRC configuration is not implemented. Rows 60-62, 67. R2 action: develop common understanding on the operation.

- the detail SSB configuration of aTRP, and including whether such IE is also applicable for mTRP (4.1), why put it under SSB-MTC (4.2), wheher there is a disconnect on the application of PUCCH-SpatialRelationInfo (4.4.),

- How to indicate serving cells, which will share common TCI state i.e. share the MAC CE and DCI from one reference serving cell (this issue is also related to the configuration of beamAppTime-r17).

3.1 PUCCH power control configuration for FR1

RAN2 had received the below input in excel “MAC CE impacts” in [5] from RAN1 related to PUCCH power control MAC CE for FR1 operation:

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| Two PUCCH power control parameter set activation/deactivation MAC CE | RAN2 to decide | Activating two power control parameter sets for mTRP PUCCH repetition.  | **Agreement**For the case of multi-TRP, to support per-TRP power control in FR1, the linking of PUCCH resource with [one or] two power control parameter sets, the following is supported• MAC-CE indicates RRC IE that configures power control parameter sets (p0, pathloss RS ID, and a closed-loop index).o The exact design of RRC IE is up to RAN2 but from RAN1 point of view, one possible example is to reuse PUCCH-SpatialRelationInfo except for the referenceSignal Note: It is common understanding in RAN1 that one PUCCH resource can be linked to one power control parameter set. |

In RAN2”116bis RAN2 agreed to have new IE for power control for mTRP FR1.

* add a new IE for power control for mTRP FR1 operation and consult on the number of power control sets to be configured.
* [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.

Further RAN2 formulated the below question to RAN1 about the PUCCH power control operation on FR1 in [3]:

*For mTRP PUCCH, RAN2 has agreed to add a new IE for power control for mTRP FR1 operation. However, RAN2 would need information on the number of power control sets to be configured with respect to the each TRP and then in relation to the corresponding MAC CE.*

***Question 2.1:*** *How many power control sets needs to be configured with respect to the each TRP and then in relation to the corresponding MAC CE per UE/cell/BWP?*

Regardless that there is question to RAN1 on at least on the number of configured sets per UE/cell/BWP, RAN2 can discuss further on potential RRC implementation on the PUCCH power control sets. Both L1 parameter input and MAC CE input advice that the PUCCH-PowerControlSetInfo is “same as Rel-16 PUCCH-SpatialRelationInfo without referenceSignal.”. This would correspond to the below ASN1:

PUCCH-PowerControlSetInfo-r17 ::= SEQUENCE {

 pucch-PowerControlSetInfoId-r17 PUCCH-PowerControlSetInfoId-r17

 p0-PUCCH-Value-r17 INTEGER (-16..15),

 pusch-ClosedLoopIndex-r17 ENUMERATED { i0, i1 },

 pucch-PathlossReferenceRS-Id PUCCH-PathlossReferenceRS-Id

}

PUCCH-PowerControlSetInfoId-r17 ::= INTEGER (1.. maxNrofPowerControlSetInfos-r17)

As the idea seems to be to configure a list of these info’s such that MAC CE may then select one or two of these for a PUCCH resource, it is suggested to have ToAddModLists in PUCCH-Config. Additionally, it is suggested that parameters indicated in Rows 36,37 in [2] are added under PUCCH-Config. The corresponding ASN1 is given below:

PUCCH-Config ::= SEQUENCE {

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 [[

 powerControlSetInfoToAddModList-r17 SEQUENCE (SIZE (1..maxNrofPowerControlSetInfos)) OF PUCCH-PowerControlSetInfo-r17

 OPTIONAL, -- Need N

 powerControlSetInfoToReleaseList-r17 SEQUENCE (SIZE (1.. maxNrofPowerControlSetInfos)) OF PUCCH-PowerControlSetInfoId-r17

 OPTIONAL, -- Need N

 secondTPCFieldDCI-0-1-r17 ENUMERATED {enabled} OPTIONAL, -- Need R

 secondTPCFieldDCI-0-2-r17 ENUMERATED {enabled} OPTIONAL -- Need R

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

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| ***powerControlSetInfoToAddModList***Configures power control sets for FR1 for a UE configured with two SRS resources sets. FFS: how to state mTRP, for now “two SRS sets” is used. FFS: link to MAC CE operation/MAC specification.  |
| ***secondTPCFieldDCI-1-1, secondTPCFieldDCI-1-2***A second TPC field can be configured via RRC for DCI-1-1 and DCI-1-2. Each TPC field is for each closed-loop index value respectively (i.e., 1st /2nd TPC fields correspond to “closedLoopIndex” value = 0 and 1. |

**Proposal1 The current running RRC CR is updated with the yellow highlighted ASN1 for PUCCH power control and the corresponding MAC CE is further progressed under 38.321 discussion.**

**Q1: Please indicate whether your company agrees on Proposal 1 and given any further input if needed**

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| Company | Agree proposal 1 | Comments |
| OPPO | Yes but | In PUCCH-SpatialRelationInfo, the P0-PUCCH is configured as an ID which demands 3 bits. But here the p0-PUCCH-Value-r17 in new structure need 5 bits. Maybe we can simply reuse p0-PUCCH-Id instead of p0-PUCCH-Value-r17 |
| Ericsson | yes | pucch-PathlossReferenceRS-Id PUCCH-PathlossReferenceRS-IdWith at least this fix. Could be fine to use p0-PUCCH-Id and not encode the same thing again. |
| Huawei, HiSilicon | Yes with comments | Typo in ASN.1. It should be SecondTPCFieldDCI-1-1 and SecondTPCFieldDCI-1-2, instead of SecondTPCFieldDCI-0-1 and SecondTPCFieldDCI-0-2.Also, SRS-Config contains a list of up to 16 SRS resources sets, so saying "UE configured with 2 SRS resources sets" seems to mean that this list has exactly 2 elements, while this is obviously not the point. Suggest changing to " Configures power control sets for repetition of a PUCCH transmission in FR1. The two power control sets to be used are determined by the XX MAC CE (see TS 38321 clause xxx)". |
| Intel | Yes for the structure | Some questions: * servingCellID is missing if we compared to PUCCH-SpatialRelationInfo despite RAN1 comment that only referenceSignal is not needed from PUCCH-SpatialRelationInfo. Is it intentional?
* Pusch in pusch-ClosedLoopIndex-r17 should be pucch-ClosedLoopIndex-r17?

Agree with Huawei on clarification on powerControlSetInfoToAddModList.  |
| MediaTek | Yes | May need to fix typos mentioned above |
| vivo | Yes with comments | 1. we also agree to use P0-PUCCH-Id2. Typo(?) for:secondTPCFieldDCI-1-1-r17secondTPCFieldDCI-1-2-r17 |
| Xiaomi | Yes | We agree that servingCellID is needed, and to use p0-PUCCH-Id. |
| ZTE | yes | For mTRP, consider it is a development of REL-16, we agree that to use P0-PUCCH-ID. |
| CATT | Yes |  |
| Apple | Yes | The servingCellId is not needed since its functionality is already covered by *pathlossReferenceLinking.*  |
| Samsung |  | 1. Instead of AddMod/Release list, SEQUENCE structure is also possible that is what legacy signaling () used. But we don’t have strong view.2. We also think it is also possible for PUCCH-PowerControlSetInfo-r17 IE to reuse the same format what PUCCH-SpatialRelationInfo used:* p0-PUCCH-Id can refer the P0-PUCCH-Id IE
* pucch-PathlossReferenceRS-Id can refer the PUCCH-PathlossReferenceRS-Id instead of PUCCH-PathlossReferenceRS IE

3. it is not clear which parameters included in the power control sets could be the initial values for each TRP. At least some description or explicit signaling is needed to indicate the initial sets for each TRP if the new RRC IE for PUCCH power control sets is configured/used. |
| Fujitsu | Yes |  |
| LGE | Yes | We are not sure if servingCellID is needed, but it is true that this parameter is not excluded acc. to. RAN1 excel sheet.  |
| Nokia, Nokia Shanghai Bell |  Yes |  |
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3.2 BFD/BFR RRC configuration

The BFD/BFR RRC configuration is given in rows 60-62, 67 of [2]. While the BFD resource configuration is not in the excel RAN2 did start with initial implementation that is currently available in the running CR. However, this existing BFD resource implementation needs to be aligned with TS 38.321 which refers to the BFD sets. These sets are not as such in the running RRC. RAN2 formulated the below question to RAN1 about the BFD/BFR configuration:

*The L1 parameter excel does not have input on how to implement beam failure detection RS sets for mTRP. There is also not information on what is the maximum number of detection resources to be configured per UE per cell or per TRP. There is also not information on what is the maximum number of recovery resources to be configured per UE per cell or per TRP.*

***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?*

Implementation of BFD resources. These are given for the UE in BWP-DonwlinkDedicated in radioLinkMOnitoringConfig:

BWP-DownlinkDedicated ::= SEQUENCE {

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

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

 sps-Config SetupRelease { SPS-Config } OPTIONAL, -- Need M

 radioLinkMonitoringConfig SetupRelease { RadioLinkMonitoringConfig } OPTIONAL, -- Need M

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 [[

 sps-ConfigToAddModList-r16 SPS-ConfigToAddModList-r16 OPTIONAL, -- Need N

 sps-ConfigToReleaseList-r16 SPS-ConfigToReleaseList-r16 OPTIONAL, -- Need N

 sps-ConfigDeactivationStateList-r16 SPS-ConfigDeactivationStateList-r16 OPTIONAL, -- Need R

 beamFailureRecoverySCellConfig-r16 SetupRelease {BeamFailureRecoverySCellConfig-r16} OPTIONAL, -- Cond SCellOnly

 sl-PDCCH-Config-r16 SetupRelease { PDCCH-Config } OPTIONAL, -- Need M

 sl-V2X-PDCCH-Config-r16 SetupRelease { PDCCH-Config } OPTIONAL -- Need M

 ]]

}

Instead of adding the BFD resources to the other TRP within the radioLinkMOnitoringConfig as is the current RRC implementation, another option is to give UE two radioLinkMOnitoringConfigs in the BWP-DonwlinkDedicated.

**Q2: Which IE companies prefer to give the two BFD-sets for mTRP operation?**

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| --- | --- | --- | --- | --- |
| Company | Add the BFD resources to the other TRP within the radioLinkMOnitoringConfig | Give UE two radioLinkMOnitoringConfigs in the BWP-DonwlinkDedicated | Another option | Postpone for now and wait Ls response |
| OPPO |  | Yes. In this case “BFDRSSetId INTEGER {0..1}” should be added in the original BFD resource set so that the same updated IE structure can be reused for 2nd detection resource set. |  |  |
| Ericsson |  | Preference. Not sure if ID is needed if second set is named *radioLinkMOnitoringConfig2* |  |  |
| Huawei, HiSilicon | In the running CR, BeamFailureDetectionSet has 4 fields with names identical to fields of RadioLinkMonitoringConfig. In spite of the same names, these are different fields, so they need to have a different description, in a table for fields of BeamFailureDetectionSet In other words, this kind of structure requires one more table.  | Please provide a TP, otherwise, it is unclear whether it works well |  |  |
| Intel | We think both options are working. It is not clear why the current running CR structure should be changed to two radioLinkMonitoringConfigs. We don’t oppose it but just to understand rationales.  |  |  |  |
| MediaTek |  | We think both methods work. But we may support “two radioLinkMonitoringConfigs” , if this means least modification to original radioLinkMonitoringConfigs |  |  |
| Vivo | In Rel-17, we only discuss the TRP specific BFR, but not TRP specific RLM. We assume the motivation to configure two RadioLinkMonitoringConfig is to support TRP specific RLM. Even there is no configuration for two radioLinkMOnitoringConfigs, some clarficiation on legacy RLM is needed, e.g. RLF is triggered only when the measurement on both RLM-RS is lower than the threshold.  |  |  |  |
| Xiaomi |  | If we use a separate name for radioLinkMOnitoringConfigs, it seems that no extra ID is needed. |  |  |
| ZTE | We think both methods can work, but still think one RadioLinkMonitroringConfig does make sense since we do not have two set of CSI/SSB for RLM. |  |  |  |
| CATT |  | We think this may be clearer. And as mentioned by other companies if we use different names for the IEs then perhaps no need to have explicit BFDRSSetId field.  |  |  |
| Apple |  |  |  | The details on explicit BFD RS configuration are still under discussion in RAN1. One possible outcome is that no change (i.e. no explicit configuration) is needed. |
| Samsung | We have no strong view. Fine with either option. | We have no strong view. Fine with either option. |  |  |
| Fujitsu | Preferred slightly.In existing radioLinkMOnitoringConfig, at most 10 RS resource can be configured for RLM detection and cell specific BFD.This option is applicable for the following cases:1. the maximum number of detection resources to be configured per UE per cell is 10 or larger than 10 and these resources are shared for all detection (e.g. RLM detection, cell specific BFD and TRP specific BFD)
2. the maximum number of detection resources to be configured is per UE per cell and these resources are shared by all TRPs for TRP specific BFD
3. the maximum number of detection resources to be configured is per TRP

For case 1), if the maximum number of detection resources is 10, then only BFD-RS set id is added in the RadioLinkMonitoringRS when needed. For other cases, addition detection resources list(s) should be included in the radioLinkMOnitoringConfig. | In this option, the maximum number of detection resources to be configured should be per TRP. If the maximum number of detection resources to be configured is per UE per cell, this option is not feasible. |  | Yes. How to implement beam failure detection RS sets for mTRP needs to take RAN1 response into account. |
| LGE | Both options work, but we slightly prefer this option as it is already in the running CR.  |  |  |  |
| Nokia, Nokia Shanghai Bell | Preference | Acceptable |  | This seems more like RAN2 decision to make, so no need for an LS |
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Related to row 61, RAN2 was suppose to make a decision:

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| --- | --- | --- | --- | --- |
| schedulingRequestIDForMTRPBFR | scheduling request configuration(s) for MTRP BFR. | One SchedulingRequestId or two SchedulingRequestIdsin MAC-CellGroupConfig | Per Cell Group | This parameter is optionally configured. FFS: Whether two PUCCH-SR resources are under the same or different SR resource configuration or SR configuration |

RAN2 agreed the following:

* 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*.

This would mean, if interpreted correctly, that a schedulingRequestID-BFR-SCell2-r17 is added to the MAC-CellGroupConfig as below:

-- ASN1START

-- TAG-MAC-CELLGROUPCONFIG-START

MAC-CellGroupConfig ::= SEQUENCE {

 drx-Config SetupRelease { DRX-Config } OPTIONAL, -- Need M

 schedulingRequestConfig SchedulingRequestConfig OPTIONAL, -- Need M

 bsr-Config BSR-Config OPTIONAL, -- Need M

 tag-Config TAG-Config OPTIONAL, -- Need M

 phr-Config SetupRelease { PHR-Config } OPTIONAL, -- Need M

 skipUplinkTxDynamic BOOLEAN,

 ...,

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 csi-Mask BOOLEAN OPTIONAL, -- Need M

 dataInactivityTimer SetupRelease { DataInactivityTimer } OPTIONAL -- Cond MCG-Only

 ]],

 [[

 usePreBSR-r16 ENUMERATED {true} OPTIONAL, -- Need R

 schedulingRequestID-LBT-SCell-r16 SchedulingRequestId OPTIONAL, -- Need R

 lch-BasedPrioritization-r16 ENUMERATED {enabled} OPTIONAL, -- Need R

 schedulingRequestID-BFR-SCell-r16 SchedulingRequestId OPTIONAL, -- Need R

 drx-ConfigSecondaryGroup-r16 SetupRelease { DRX-ConfigSecondaryGroup } OPTIONAL -- Need M

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 enhancedSkipUplinkTxDynamic-r16 ENUMERATED {true} OPTIONAL, -- Need R

 enhancedSkipUplinkTxConfigured-r16 ENUMERATED {true} OPTIONAL -- Need R

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 [[

 schedulingRequestID-BFR-SCell2-r17 SchedulingRequestId OPTIONAL, -- Need R

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}

DataInactivityTimer ::= ENUMERATED {s1, s2, s3, s5, s7, s10, s15, s20, s40, s50, s60, s80, s100, s120, s150, s180}

-- TAG-MAC-CELLGROUPCONFIG-STOP

-- ASN1STOP

**Q3: Do companies agree that the correct implementation of the corresponding RAN2 agreement is to add second ID under MAC-CellGroupConfig** schedulingRequestID-BFR-SCell2-r17**?**

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| --- | --- | --- |
| Company | Agree yes/no | comments |
| OPPO | No | Please refer to answer to Q4.In addition schedulingRequestID-BFR-SCell-r16 can be reused for SpCell also, so maybe it should be renamed as “schedulingRequestID-BFR-r16” and the field description should be updated:***schedulingRequestID-BFR***Indicates the scheduling request configuration applicable for BFR on SCell or SpCell, as specified in TS 38.321 [3]. |
| Ericsson | no | Rather than adding second ID, one should add two new IDs. E.g. schedulingRequestID-BFR and schedulingRequestID-BFR2 |
| Huawei, HiSilicon | No | In Rel-17 mTRP BFR, both SpCell and SCell may trigger SR due to no available UL resources for BFR MAC CE transmission. Adding a second ID called schedulingRequestID-BFR-SCell2-r17 indicates a SR configuration for SCell BFR only, which is not correct.Can introduce two new SR IDs for mTRP BFR. |
| Intel | No | Agree with above observations from the companies.  |
| MediaTek | No |  |
| Vivo | No | Comparing adding one IE, we actually prefer to introduce two parameters, i.e. schedulingRequestID-BFR1-r17 and schedulingRequestID-BFR2-r17 to indicate two corresponding SR(s) for R17 BFR. A configuration restriction should be added for R17 MTRP BFR. The IE schedulingRequestID-BFR1-r17 or schedulingRequestID-BFR2-r17 should be configured with same SchedulingRequestId with schedulingRequestID-BFR-SCell-r16. |
| Xiaomi | No | It seems that we should add two new IDs to avoid some misunderstandings at the UE. |
| ZTE | No |  |
| CATT | No |  |
| Apple | No | Two IDs are needed in R17. |
| Samsung | See comments | Two new fields should be addedschedulingRequestID-BFR-r17 and schedulingRequestID-BFR2–r17 |
| Fujitsu | No | We prefer one or two separate ID under MAC-CellGroupConfig because SR can be triggered for SCell BFR and TRP BFR for different cell in one cell group at the same time. |
| LG |  | Since the two SR IDs can be used for SpCell mTRP BFR, it should be renamed.  |
| Nokia, Nokia Shanghai Bell | No |  As others have said: don't we need two newI IDs? It's not good to keep using maginc numbers in variable names, but e.g. Samsung/Ericsson suggestion seems fine. |
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Then, row 68 is about associating failure detection resources to PUCCH-SR/SR configuration. However, it is advised to configure this either per cell group or per BWP. Further it is unclear which parameters “SchedulingRequestIDForMTRPBFR Or SchedulingRequestResourceIDForMTRPBFR” actually are.

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| AssociatedFailureDetection-ResourceList | Indication of the FailureDe-tectionResourceList associated with the PUCCH-SR/SR configuration. | {0,1} | Per Cell Group or per BWPin SchedulingRequestIDForMTRPBFR OrSchedulingRequestResourceIDForMTRPBFR |

**Q4: Please give your company understanding on how this association is intended to work? Per cellgroup or per BWP? Are these schedulingrequest IDs that of cell group or that of PUCCH-Config? How do you place configuration \_in\_ requestID? Or, should it be placed in schedulingrequestconfig itself?**

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| --- | --- |
| Company | Explanation |
| OPPO | We can put schedulingRequestID-BFR within RadioLinkMonitoringConfig. So once a BM failure is detected based on one resource set, UE can know which SchedulingRequestID it should refer to. Then SchedulingRequestResourceID can be found via SchedulingRequestID just like before.The IE schedulingRequestID-BFR is optional within RadioLinkMonitoringConfig. If it is absent, it means schedulingRequestID-BFR-SCell-r16 is used. In this case the new schedulingRequestID-BFR can be used for both association between beam failure detection and scheduling request id, and to configure additional schedulingRequest-BFR. If it is agreed, the cell group level IE can be removed. |
| Ericsson | Perhaps the field description of each ID(E.g. schedulingRequestID-BFR and schedulingRequestID-BFR2) tells the association and thus this parameter in the L1 excel becomes redundant.  |
| Huawei, HiSilicon | We understand this parameter intends to associate one SR configuration to one TRP, i.e., associate one SchedulingRequestIDForMTRPBFR to one BFD-RS-Set ID. There could be two SchedulingRequestIDForMTPBFR per cell group, we can associate SchedulingRequestIDForMTPBFR0 to BFD-RS-Set ID 0, and associate SchedulingRequestIDForMTPBFR1 to BFD-RS-Set ID 1. |
| Intel | This parameter is used for gNB to configure the association between SchedulingRequestId and BFD-RS set. Supposedly, it is per BWP. If we put it in per cell group, it seems we need AssociatedFailureDetection-ResourceList per cell.  |
| MediaTek | Agree with Ericsson. |
| Vivo | We prefer to put schedulingRequestID-BFR into MAC-CellGroup, which will not change the current RRC structure. When SpCell is MTRP, two SR for BFR should be configured. The default schedulingRequestID-BFR1-r17 is associated with BFR-RS set#1, while schedulingRequestID-BFR2-r17 is associated with BFR-RS set#2. If Beam failure occurs on one BFD-RS set, the corresponding SR will be triggered. When SpCell is aTRP, it will fall back to R16, where one SR is enough. |
| Xiaomi | We could use the field description to tell the association as mentioned by Ericsson. |
| CATT | We think it should be per cell group. And we tend to agree that the field descriptions for the two ID can indicate the association, e.g. schedulingRequestID-BFR is associated to BFDRSSetId=0, schedulingRequestID-BFR2 is associated to BFDRSSetId=1. |
| Apple | Agree with Ericsson.  |
| Samsung | schedulingRequestID-BFR-r17 and schedulingRequestID-BFR2–r17 are included in CellGroupConfig.If both are configured, schedulingRequestID-BFR-r17 can be implicitly applied for BFD-RS set 0 and schedulingRequestID-BFR2–r17 can be can be implicitly applied for BFD-RS set 1 |
| Fujitsu | Considering that BFD-RS set is configured per BWP, per BWP configuration is preferred. As OPPO commented, SR IDs can be indicated in the RadioLinkMonitoringConfig. |
| LGE | This parameter is about whether to associate each SR PUCCH resource with each BFD RS set when two SR PUCCH resources are configured for mTRP BFR. In our view, this can be configured together with the two SR IDs under MAC-CellGroupConfig. |
| Nokia, Nokia Shanghai Bell | Per BWP: Current mTRP has been linked to BWP usage: Some BWPs may use mTRP while others don't. So the linking can be done via PUCCH-Config (which is per BWP). |
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Then, the rows 62 and 63 are about candidate beam resource configurations:

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| --- | --- | --- | --- | --- |
| 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. For Pcell both lists need to be added.

**Proposal 2 RAN2 to agree on adding candidateBeamresourceList2 in IE BeamFailureRecoverySCellConfig and both candidateBeamresourceList and candidateBeamresourceList2 in IE BeamFailureRecoveryConfig.**

**Q5: Please indicate whether your company agrees on Proposal 2 and given any further input if needed**

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| Company | Agree proposal 2 | Comments |
| OPPO | Yes |  |
| Ericsson | yes |  |
| Huawei, HiSilicon | No | BeamFailureRecoveryConfig is per UL BPW but candidateBeamresourceList should be per DL BWP. |
| Intel | Yes |  |
| MediaTek | Yes |  |
| vivo | Yes |  |
| Xiaomi | Yes |  |
| ZTE | Yes |  |
| CATT | Yes |  |
| Apple | Yes | In addition, we think additionalPCI can be added for each candidate beam resource with regard to BFR for inter-cell mTRP operation. |
| Samsung | Yes |  |
| Fujitsu | Yes | Whether RAN1 remaining issue will impact RAN2 implementation needs further discussion. |
| LGE | Yes |  |
| Nokia, Nokia Shanghai Bell | Yes | Adding the mTRP-specific configuration to BeamFailurerecoverConfig and BeamFailureRecoverySCellConfig seems simplest way to go. |
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3.3 Details of the additional PCI/SSB configuration for aTRP

As per WID, both beam management and mTRP operation support the so-called “intercell” operation which boils down to associating additional PCI/SSB(set) under serving cell configuration in addition to the main/original PCI and related SSB(set) information.

The excel gives rows 13, 53 and 54 that are related to this “intercell” operation.

Currently the running RRC CR has the new IE structure is under SSB-MTC and is as follows:

SSB-MTCAdditionalPCI-r17 ::= SEQUENCE {

 additionalPCIIndex-r17 AdditionalPCIIndex,

 additionalPCI-r17 PhysCellId,

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

 ssb-ToMeasure-r16 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 ::= INTEGER{FFS}

This is then given to the UE in IE ServingCellConfig. Then the added PCI is linked to CSI-SSB-ResourceSet as adviced by row 13 of [2]. The added PCI is given in both Rel 15/16 TCI state as well as in Rel-17 TCI state. The added PCI is also linked to PUCCH-SpatialRelationInfo as row 53 advices to support “intercell mTRP” operation and Rel 15/16 does not have “UL TCI states” but spatial relation is used in UL.

The following open issues have been raised regarding the current implementation:

***Additional issue 4.1:*** *whether such IE is also applicable for mTRP*

***Additional issue 4.2:*** *it is not sure why running CR rapporteur put it under SSB-MTC . the IE itself is more about definition of SSB of aTRP but not measurement*

***Additional issue 4.3a:*** *Regarding to L1 inter-cell measurement, in the current RRC running CR, all SSB resources in a CSI-SSB-Resource set are associated with one same additional PCI. However, RAN1 also has agreement in RAN1 #104bis-e: “In one reporting instance, depending on NW configuration, beam(s) associated with a non-serving cell can be mixed with that associated serving-cell”. This could mean that the additional PCI could be per SSB index.*

***Additional issue 4.3b:*** *Also, RAN1’s description is: “ 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.” in which it seems there are multiple PCIs in one CSI-SSB-ResourceSet RAN2 to discuss if the current CR meets RAN1’s intention.*

***Additional issue 4.4:*** *Regarding to PUCCH-SpatialRelationInfo, in the current running CR, one additional PCI is added in this IE. However, we don’t see RAN1 agreements related to this. In inter-cell BM, PUCCH beam direction is following UL TCI state or joint TCI state. In inter-cell mTRP, now only multi-DCI multi-PDSCH is discussed, and there is no discussion in PUCCH spatial relation. RAN2 can discuss whether this is needed.*

The issue 4.1 seems to be addressed by the excel row 53 that advices to support mTRP operation with the added PCI. Related to issues 4.3a,b the following question was added to the LS [3]

***CSI-SSB-ResourceSet***

***Question 1.13:*** *Should it be possible for different SSB indexes in the same CSI-SSB-ResourceSet to be associated with different additionalPCI?*

The issues 4.2, and 4.4 can be further discussed here.

**Q6: Please indicate whether companies agree on the content of the new IE structure SSB-MTCAdditionalPCI-r17?**

|  |  |
| --- | --- |
| Company | Comments content of the IE SSB-MTCAdditionalPCI-r17 |
| OPPO | We agree that the same IE is also applicable for mTRP operation. And the relevant RAN1 agreements about mTRP can be found in RAN1 LS R1-2108633. The LS suggests that at least following content should be contained:1, non-serving cell PCI(included)2, SSB time domain position (included, see more comments below)3, SSB transmission periodicity(included)4, SSB transmission power (not included yet)As for SSB time domain position we think this is should be reflected by ssb-PositionsInBurst as in SIB1 instead of SSB-ToMeasure, which is used for measurement purpose.Additionally we think this new IE should be easily extended to contain more information for forward compatibility considering Rel18 will likely specify L1/L2 based mobility, e.g.5, ssb-Freq-r166, halfFrameIndex-r167, ssbSubcarrierSpacing-r16In Rel17 our understanding is that SSB in aTRP will have same frequency, SCS and half frame structure. |
| Ericsson | The FFSs on the structure need more input from RAN1. It is assumed RAN1 will make effort to update RAN2 on FFSs across the excel. |
| Huawei, HiSilicon | We think the current implementation of SSB-MTCAdditionalPCI-r17 is fine. SSB transmission power is to be added. |
| Intel |  We are ok to introduce SSB-MTCAdditionalPCI-r17 in serving cell config and agree that SSB transmission power should be included. Regarding Question 1.13, it seems that RAN1’s intention is to have different PCI per SSIB index in *CSI-SSB-ResourceSet.* Please see below RAN1’s agreement related to this. On Rel.17 multi-beam measurement/reporting enhancements for L1/L2-centric inter-cell mobility and inter-cell mTRP, * In one reporting instance, depending on NW configuration, beam(s) associated with a non-serving cell can be mixed with that associated with serving-cell
 |
| MediaTek |  We are fine with current SSB-MTCAdditionalPCI-r17; the content may be modified according to further RAN1 input or RAN2 agreements. |
| vivo | Current implementation is fine for us.  |
| Xiaomi | We are to consider the above IE as the baseline. |
| ZTE | Fine with the current version |
| CATT | We are basically fine with the current content. |
| Apple | We think SSB transmission power should be included according to the following RAN1’s agreement**Agreement**At least following non-serving cell SSB information are needed in inter-cell MTRP operation * SSB time domain position
* SSB transmission periodicity
* SSB transmission power

FFS: Other non-serving cell informationFFS: Whether indication of these information is implicit or explicit  |
| Samsung | Fine with the current version would be the baseline. |
| Fujitsu | The current version is fine. |
| LGE | The suggested IE structure can be baseline  |
| Nokia, Nokia Shanghai Bell | Overall the structure looks fine with minor clarifications.1. We agree that the additional PCI is used for both mTRP and ICBM.
2. If we also want to allow to be associated multiple SSBs, then a list of SSBs (each with different SSB periodicity and SMTC) for the PCI would be needed, e.g.. as follows:

SSB-MTC-AdditionalPCI-r17 ::= SEQUENCE {  additionalPCI-Index-r17 AdditionalPCI-Index,  additionalPCI-r17 PhysCellId,  ssb-List-r17 SSB-List-r17, ...}SSB-List-r17 ::= SEQUENCE (SIZE (1..maxSSB-r17) OF SSB-r17SSB-r17 ::= SEQUENCE { ssb-periodicity-r17 ENUMERATED { ms5, ms10, ms20, ms40, ms80, ms160, spare2, spare1 } OPTIONAL, -- Need S--Editor's note: IE may need to be defined for this value range. ssb-ToMeasure-r17 SetupRelease { SSB-ToMeasure } OPTIONAL -- Need M}1. Hyphen needs to be used after acronym as per RRC naming rules, e.g. *AdditionalPCIIndex* --> *AdditionalPCI-Index*
2. The -r17 suffixes shuold be added for the Rel-17 fields, even if they replicate the Rel-15/16 ones (and IE definitions can be introduced if there is value range duplication)
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**Q7: Please comment whether the new IE should be places under SSB-MTC or some other IE, or define new?**

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| --- | --- |
| Company | Comments placement of the IE SSB-MTCAdditionalPCI-r17 |
| OPPO | The list of new IE should be configured within ServingCellConfig as suggested by the excel table and rapporteur. We have no strong opinion on where to define the new IE structure and slightly prefer to put under ServingCellConfig too. |
| Ericsson | Current placement seemed best fit. However, open to other suggestions if better place is found. |
| Huawei, HiSilicon | In ServingCellConfig is ok. |
| Intel | We are ok to introduce SSB-MTCAdditionalPCI-r17 in serving cell config. |
|  | We are fine to have it in ServingCellConfig. |
| vivo | We prefer to configure it in servingCellConfig. |
| Xiaomi | We are fine to keep it in ServingCellConfig. |
| ZTE | ServingcellConfig |
| CATT | OK to put it under ServingCellConfig. |
| Apple | Fine to keep it in the ServingCellConfig. |
| Samsung | Under the ServingCellConfig |
| Fujitsu | Fine to keep it under the ServingCellConfig. |
| LGE | We are fine to place it under ServingCellConfig. . |
| Nokia, Nokia Shanghai Bell | Under SSB-MTC seems straightforward. |
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**Q8: Please indicate whether your company agrees that additionalPCI is needed to support UL mTRP operation, that is to include it in PUCCH-SpatialRelationInfo?**

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| --- | --- | --- |
| Company | Yes/no | Comments |
| OPP | No | Regarding PUCCH-SpatialRelationInfo, there is still argument in RAN1 that additional PCI can be applied to UL. No agreement is likely to be made. Suggest to delete additional PCI from UL so far. |
| Ericsson | yes | This is our understanding as mTRP does not use UL TCI states and without this intercell UL for mTRP is not supported. |
| Huawei, HiSilicon | No | Regarding to UL mTRP operation, mTRP PUCCH/PUSCH repetitions are in the scope of Rel-17 FeMIMO. These two features have no relation with inter-cell operations, so the additionalPCI is not needed in PUCCH-SpatialRelationInfo.Regarding to inter-cell mTRP feature, until now, RAN1 and RAN2 only discussed multi-DCI multi-PDSCH reception, i.e,, the TCI state can indicate a QCL RS (associated with the serving cell or an additional cell) for downlink reception. There is no enhancement for PUCCH transmission. Therefore, we believe that the additionalPCI field should not exist in PUCCH-SpatialRelationInfo. |
| Intel | No | We understand inter-cell mTRP is not supported for PUCCH. So, addition PCI is not needed.  |
| MediaTek | No | Intel-cell mTRP is not supported for PUCCH |
| vivo | No | We share the similar view as OPPO, whether additional PCI can be applied to UL has not been decided.  |
| Xiaomi | No | Agree with other that intel-cell mTRP is not supported for PUCCH. |
| ZTE | Yes | Agree with Ericsson |
| CATT | See comments | If RAN1 do not have conclusion on this then perhaps not needed. |
| Apple | No | This was discussed in RAN1, but there is no consensus.  |
| Samsung | No | Need to check RAN1 status. |
| Fujitsu | No |  |
| LGE | No | Extending mTRP UL repetition to inter-cell is out of scope in the WI.  |
| Nokia, Nokia Shanghai Bell | Yes | Same as for ICBM: UL and DL may be using different TRPs, so the PCI information shuold be supported for both. |
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3.4 “How to indicate a list of serving cells”

An open issue as stated below was added to the open issue list during the port RAN2 116bis email discussion on the open issue list [4]:

***Open issue 7****: How to indicate serving cells, which will share common TCI state i.e. share the MAC CE and DCI from one reference serving cell.*

*This issue is also related to the configuration of beamAppTime-r17*

***RAPP comment:*** *MAC CE should use the concept of existing cell lists(provided I understood the added issue correctly).*

However, it is not clear what this open issue exactly refers to. It could be related to row 72 or to row 19 in [2]. If it related to row 72, the rapporteur understanding is that the existing r16 lists simultaneousTCI-UpdateList1, simultaneousTCI-UpdateList2 are referred to in the new MAC CE that activates two TCI states per CORESET and that the operation follows that of Rel-16. In this case, the open issue relates only to Rel 15/16 TCI state operation and is not related to beamAppTime.

**Proposal 3 RAN2 understanding of row 72 is that the existing r16 lists simultaneousTCI-UpdateList1, simultaneousTCI-UpdateList2 are referred to in the new MAC CE that activates two TCI states per CORESET and that the operation follows that of Rel-16.**

**Q9: Whether companies agree on Proposal 3**

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| Company | Agree proposal 3 | Comments |
| OPPO | Yes but |  Row72 (row71 in R1-2112976) has already address by the new MAC CE “Enhanced TCI States Indication for UE-specific PDCCH MAC CE” endorsed in MIMO MAC running CR R2-2201994.Row19 (row18 in R1-2112976) is about for one CC/BWP how to refer to TCI state pool in another CC/BWP i.e. RRC level reference.So called “share common TCI state” is similar to what has done for activate TCI state of PDCCH/PDSCH simultaneously for a list of serving cell i.e. in Rel17 the MAC CE to activate Rel17 unified TCI states can be applicable for a list of serving cell. In case RAN1 confirm that Rel16 and Rel17 TCI state frame work is exclusively configured, then existing simultaneousTCI-UpdateList1 or simultaneousTCI-UpdateList2 can be reused. Otherwise one or two additional R17 list should be configured to avoid any collision. But we can leave this FFS and wait for RAN1’s response.It is related to the configuration of parameter beamAppTime is because RAN1 agreed that the beamAppTime should be same across list of serving cells who share common TCI state. |
| Ericsson | yes | This is our understanding that the previous lists are used. We have also related question in the RAN1 LS. |
| Huawei, HiSilicon | yes but | We understand this open issue is for the configuration of reference CC in the unified TCI framework (row 19 of the RRC list). |
| Intel | Yes | We have the same understand as OPPO that row 72 is related to the new MAC CE “Enhanced TCI States Indication for UE-specific PDCCH MAC CE” for HST-SFN feature. And the row 19 is about the reference cell ID and BWP ID for common TCI state update.  |
| MediaTek | Yes |  |
| vivo | See comments | In our understanding, RAN1 will discuss The UE is not expected to be configured with Rel-15/Rel-16 TCI/SpatialRelationInfo***/PUCCH-SpatialRelationInfo* (except *spatialRelationInfoPos*)** if the UE is configured with Rel-17 TCI in any CC in a band in this Feb. meeting. In this case, we could consider to reuse CC lists for R16. |
| Xiaomi | Yes |  |
| ZTE | Yes |  |
| Apple | No | RAN1 reached an offline consensus to introduce a new RRC parameter about it. |
| Samsung | Yes |  |
| Fujitsu | Yes |  |
| LGE | Yes but | Agree that Rel-16 approach can be adopted. We think however that RAN1 may plan to discuss whether to introduce new RRC parameter for this function or to reuse r16 parameters. Anyway, we can take reusing the existing IEs as baseline.  |
| Nokia, Nokia Shanghai Bell |  | Since this seems to be majority view, we can accept it but would like to understand what this really means: How will the R16 and R17 operation be differentiated if the same fields are used? Will all UEs implementing the Rel-17 behaviour then also implement the Rel-16 behaviour (since that would be controlled by the same parameter)? |
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However, maybe the open issue raised relates to row 19. The implementation of row 19 was left for the rapporteur to suggest the implementation as input to RAN2#117. However, any input from other companies is also welcome.

**Q10: Companies are welcome to give input or suggestion to implementation of row 19 of the L1 parameter excel.**

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| --- | --- |
| Company | Comments |
| OPPO | In current running CR in PDSCH-Config joint/Dl TCI state pool is configured and in BWP-UplinkDedicated UL TCI state pool is configured. Assuming another CC/BWP will not configure those detail TCI state pool, then it can refer to one of the CC/BWPs to show they share the same pool definition. So we think following change is needed to address row19 (row18 in R1-2112976):1, to add reference serving cell id and BWP id in PDSCH-Config in case it refers to joint/DL TCI state pool of reference CC/BWP2, to add reference serving cell id and BWP id in BWP-UplinkDedicated in case it refers to UL TCI state pool of reference CC/BWP3, For both IE, we can set up a choice structure i.e. for one specific BWP, it either configures detail TCI state pool or it refer to another CC/BWP |
| Ericsson | This would be the rapp suggestion and any comments would be welcomePDSCH-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 beamAppTime-r17 FFStype OPTIONAL, -- Need R sfnSchemePdsch-r17 ENUMERATED {sfnSchemeA,sfnSchemeB} OPTIONAL -- Need R ]]} RefUnifiedTCIStateList-r17 ::= SEQUENCE { servingcell-r17 ServCellIndex-r17 bwp-r17 BWP-Id-r17}***refUnifiedTCIStateList***Provides the serving cell and BWP where the configuration for DLorJoint-TCIState-ToAddModList-r17 is for this serving cell and BWP. When this field is present, DLorJoint-TCIState-ToAddModList and DLorJoint-TCIState-ToReleaseList are not present. |
| Huawei, HiSilicon | We need to ask RAN1 to clarify how many reference CCs can be configured in a cell group. In addition, we need to consider a situation: a TCI state list is configured in a BWP of a serving cell, can this BWP of this serving cell also has a reference CC/BWP? If yes, there can be two ways to indicate TCI state for this BWP of this serving cell. Can ask RAN1 to clarify. |
| Intel | One possible structure for it is to have CHOICE between reference cell ID/BWP ID and the unified TCI state list. |
| MediaTek | We agree with Rapporteur’s intention to introduce “refUnifiedTCIStateList”, but the name is a bit confusing: Readers may think it contains a list of sometinhg, but actually it does not. Maybe we should call it “refBWP-UnifiedTCI-State”? |
| Vivo | We prefer to configure one reference BWP/CC in one CC list, where TCI state pool will be configured on this reference BWP/CC. Other BWP/CC in this CC list will refer to this reference BWP/CC.Besides, TCI state pool could be configured on multiple CC in the CC list. When performing common TCI state update, all CC(s) in the CC list should have same QCL-TypeD RS or QCLed based on common TCI state ID. |
| Xiaomi | We are fine to consider the IE structure provided by Ericsson as the baseline. |
| Apple | The structure proposed by Ericsson is fine.  |
| Samsung | We are fine for this version as baseline. |
| LGE | Rapporteur’s structure is fine but CHOICE between a reference and unified TCI state list seems a bit more straightforward  |
| Nokia, Nokia Shanghai Bell | To be clear, we assume this is about the PDSCH configuration for TCI states, i.e. the row that states this: "PDSCH configuration for each CC/BWP. The reference CC/BWP includes the Rel-17 TCI state pool (a list of TCI states) for PDSCH", for which granularity has been listed as " Per UE per cell per BWP in BWP-DownlinkDedicated".We assume the question is how to configure the TCI states: As the PDSCH-Config already contains list of TCI states (list of TCI-State IE), which is extendible, it seems reasonable to just assume those are reused for this. That is, the information is added to the TCI-State IE e.g. as per below:TCI-State ::= SEQUENCE { tci-StateId TCI-StateId, qcl-Type1 QCL-Info, qcl-Type2 QCL-Info OPTIONAL, -- Need R ..., [[ -- Rel-17 fields (e.g. PCI association and indication on whether this is joint UL/DL TCI state) are added here additionalPCI-r17 AdditionalPCI-Index-r17 OPTIONAL, -- Need R jointTCI-State-r17 ENUMERATED {true} OPTIONAL -- Need R ]]}Note that we assume these were separated to different lists in the running CR just to make clear what they were intended to be, but this doesn't seem necessary. Also, the current TCI state is DL TCI state by default, so since it was decided to separate the UL TCI state to its own list, the "type" indication is only about whether this is a joöint UL/DL TCI state (i.e. if that is not present, this is a DL TCI state).  |
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# 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.

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* 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.