3GPP TSG-RAN WG2 Meeting #116bis Electronic [R2-21xxxxx](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_116-e/Docs/R2-2111325.zip)

Elbonia, January 2022

**Agenda item: 8.17.2**

**Source: Ericsson**

**Title: Summary**

**WID/SID: NR\_FeMIMO-Core - Release 17**

**Document for: Discussion and Decision**

# Introduction

[R2-2201560](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116bis-e\Docs\R2-2201560.zip) Running RRC CR for FeMIMO Rel-17 Ericsson draftCR Rel-17 38.331 16.7.0 NR\_feMIMO-Core Late

- has implemented all L1 parameter, except the one under discussion and with FFSes from R1.

* Review offline
* [AT116bis-e][052][feMIMO] RRC progress (Ericsson)

Scope: a) Review R2-2201560, to be endorsed if possible, b) Continue R2-2200015, take agreements into account, attempt to progress further, take also into account R2-221xxxx c) Collect Questions for R1 in an LS out. Identify Open Issues.

Intended outcome: Report, with agreements, CB points

Deadline: CB points CB Mon W1, Otherwise EOM

RAN2#116 and 116bis agreements are listed in the appendix.

Note that BFD/BFR related parameters are not discussed here due to overlap with other AI(Samsung summary)

# 2 Contact Points

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

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| Ericsson | Helka-Liina Määttänen | Helka-liina.maattanen@ericsson.com |
| Huawei, HiSilicon | David Lecompte | david.lecompte@huawei.com |
| Intel | Youn Heo | Youn.hyoung.heo@intel.com |
| Xiaomi | Yumin Wu | wuyumin@xiaomi.com |
| OPPO | ZhongdaDu | duzhongda@oppo.com |
| Samsung | Seungri Jin | seungri.jin@samsung.com |
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# 3 Beam management

## 3.1 Unified TCI state operation RRC&MAC

Related to configuring UL/DL/joint TCI state lists there are the following agreements:

* 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.”
* 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

What is not yet concluded is the TCIstateId handling and related MAC CE design. The options are

* one TCIstateId pool for joint/DL TCI state and separate TCIstateId
* common TCIstateId pool across join/DL and UL TCI states

The MAC CE operation for joint unified TCI state maps 8 joint unified TCI states to the 8 corresponding DCI codepoints. However, for separate unified TCI state operation, there are 1 or 2 UL/DL unified TCI states mapped to each DCI codepoint. This means there are 8-16 TCI state IDs present in the MAC CE independent of whether joint or common id pool is used.

If comparing the necessary content of the MAC CE for separate unified TCI state operation only from TCI state ID perspective and leave for now all assisting fields out we have two baseline starting points. For simplicity we assume here that all 8 DCI codepoints are mapped to both UL and DL TCI states.

**Unified TCI state MAC CE for separate Id pool**

Can be used with existing agreements for placing joint/DL and UL TCI state lists.

|  |  |  |  |
| --- | --- | --- | --- |
| BWP id UL (1st bit) | Serving cell ID | | BWP id DL (2 bits) |
| C | Joint/DL TCI state ID (7 bits 128 states) | | |
| F | BWP id UL (2nd bit) | UL TCI state ID (6 bits 64 states) | |
| C | Joint/DL TCI state ID (7 bits 128 states) | | |
| F | BWP id UL (2nd bit) | UL TCI state ID (6 bits 64 states) | |
| C | Joint/DL TCI state ID (7 bits 128 states) | | |
| F | BWP id UL (2nd bit) | UL TCI state ID (6 bits 64 states) | |
| C | Joint/DL TCI state ID (7 bits 128 states) | | |
| F | BWP id UL (2nd bit) | UL TCI state ID (6 bits 64 states) | |
| C | Joint/DL TCI state ID (7 bits 128 states) | | |
| F | BWP id UL (2nd bit) | UL TCI state ID (6 bits 64 states) | |
| C | DL TCI state ID (7 bits 128 states) | | |
| F | BWP id UL (2nd bit) | UL TCI state ID (6 bits 64 states) | |
| C | Joint/DL TCI state ID (7 bits 128 states) | | |
| F | BWP id UL (2nd bit) | UL TCI state ID (6 bits 64 states) | |
| C | Joint/DL TCI state ID (7 bits 128 states) | | |
| F | BWP id UL (2nd bit) | UL TCI state ID (6 bits 64 states) | |

C field describes whether octet with UL TCI state ID is present

F field describes whether UE should consider the preceding octet as padding or as DL TCI state (only needed for “separate beam indication”).

BWP id UL points to the BWP where UL TCI state list is configured

This MAC CE works also as joint TCI state indication MAC CE as UE is RRC configured for either joint or separate operation. When used as joint TCI state MAC CE, all C fields would be set to 0 and no octets for UL TCI state would be present.

**Unified TCI state MAC CE for commonId pool:**

As there is (room) for only DL BWP ID the agreements for placing the TCI state lists would need to be reverted, or RRC would pair UL and DL BWPs such that it would be enough to point out DL BWP in the MAC CE.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| R | | | Serving cell ID | | | | | BWP id DL 2bits | | | | |
| T1 | T2 | | T3 | | T4 | | T5 | T6 | | T7 | | T8 |
| T9 | | T10 | T11 | T12 | | T13 | | T14 | T15 | | T16 | |
| TCI state ID (8 bits =128+64 states) | | | | | | | | | | | | |
| TCI state ID(8 bits =128+64 states) | | | | | | | | | | | | |
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| TCI state ID(8 bits =128+64 states) | | | | | | | | | | | | |

Tn field describes whether the corresponding octet is present.

For joint unified TCI state operation every other Tn would be set to 0.

**Q1. Which option companies prefer?**

* **Option 1 Separate TCI state lists for joint/DL and UL in PDSCHConfig and UL BWP, respectively, and separate Id pools**
* **Option 2 Separate TCI state lists for joint/DL and UL in PDSCHConfig and UL BWP, respectively, and common Id pools, and mapping of UL/DL BWPs in RRC**
* **Option 3 Revert agreements on TCI state lists and have one large list in RRC PDSCHConfig where also UL TCI states are included, and common pool**
* **Option 4 other**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Company | O1 | O2 | O3 | O4 | Comments |
| Huawei, HiSilicon | Yes |  |  |  | Do we really need a different UL BWP ID for different code points?  As the legacy MAC CE indicates the TCI state for each code point when a given DL BWP is active, couldn't the new MAC CE indicate the TCI state for each code point when a give (DL BWP, UL BWP) is active?  For option 2, not sure why there is no UL BWP ID at all. |
| Intel | Yes |  |  |  | When RAN2 agreement was made for separate list, we assume that it also means separate ID should be introduced.  Regarding UL BWP ID, we think it is not necessary. Imagine that RAN2 define joint TCI state list. How do we indicate UL BWP associated to UL TCI state included in the joint TCI state list in PDSCH-Config which is per DL BWP? Somehow, semi-static relationship between DL and UL BWP should be configured in RRC signaling if we go with joint TCI state.  Based on it, even in separate TCI state list, we could assume semi-static association between DL and UL BWP. We could introduce a new RRC signaling or assume the same BWP ID between DL and UL BWP. The latter approach is already used in candidateBeamRSList definition in the legacy system. |
| Xiaomi |  | Yes |  |  | It would be simpler for the MAC CE design when we have a common TCI-state ID pool. |
| Ericsson | yes |  |  |  | UL BWP can be left out if the signaling is made other ways unambiguous. It was introduced in this example as there was comment during online that UL BWP missing is why separate lists and ID space cannot be introduced. |
| OPPO | Yes |  |  |  | We think UL BWP ID is necessary, but it should be the same for all UL TCI states within MAC CE. Fixed relation between UL and DL BWP is possible, but it also means scheduling limitation for network. There is no problem for TDD, but we see it is problematic for FDD. |
| Samsung | Yes |  |  |  | The most important point to determine the unified TCI state pool configuration and MAC CE design is that flexible usage of mapping of UL/DL TCI state when separate TCI pool ID is configured.  Option 1 is possible to support all combinations (64 x 128 = 8192) which are made by separate UL TCI state and DL/Joint TCI state but Option 2 has restriction to support only 256 (8 bits) combinations. We also think the RAN2 agreement was already agreed to use the separate list and it should be supported by separate ID.  Fo UL BWP ID for different code points, it was not discussed and RAN2 just follow the legacy operation i.e. not apply this, but RAN1 confirmation is preferred if companies doubt about this. It would be better to ask RAN1 for confirmation(?) |
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## 3.2 BAT

The latest RAN2 agreements about it reads:

* IT shall be possible to configure the parameter BeamAppTime differnet for different SCS
* FFS if parameter BeamAppTime is under the cell group config.

The SCS is configured in IE BWP which is given in BWP-DownlinkCommon and network ensures same SCS for UL and DL. Thus it seem highest place where BAT can be placed is IE BWP-DownlinkCommon.

– *BWP-DownlinkCommon*

The IE *BWP-DownlinkCommon* is used to configure the common parameters of a downlink BWP. They are "cell specific" and the network ensures the necessary alignment with corresponding parameters of other UEs. The common parameters of the initial bandwidth part of the PCell are also provided via system information. For all other serving cells, the network provides the common parameters via dedicated signalling.

***BWP-DownlinkCommon* information element**

-- ASN1START

-- TAG-BWP-DOWNLINKCOMMON-START

BWP-DownlinkCommon ::= SEQUENCE {

genericParameters BWP,

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

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

...

}

-- TAG-BWP-DOWNLINKCOMMON-STOP

-- ASN1STOP

|  |
| --- |
| ***BWP-DownlinkCommon* field descriptions** |
| ***pdcch-ConfigCommon***  Cell specific parameters for the PDCCH of this BWP. This field is absent for a dormant BWP. |
| ***pdsch-ConfigCommon***  Cell specific parameters for the PDSCH of this BWP. |

**Q2. Which option companies prefer?**

* **Option 1 keep the parameter *BeamAppTime\_r17* in PDSCH-Config?**
* **Option 2 move the parameter *BeamAppTime\_r17* to BWP-DownlinkCommon?**
* **Option 3 move the parameter *BeamAppTime\_r17* to** *ServingCellConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Option1 | Option 2 | Comments |
| Huawei, HiSilicon |  |  | We see no difference, let's keep it where it is now. |
| Intel | Yes |  | Same as Huawei. If we want to make sure that BAT is the same for DL and UL BWP, we could describe in the field description. |
| Xiaomi | Yes |  |  |
| Ericsson | Yes |  | Both work from SCS perspective. We prefer to keep it in PDSCHConfig where other unified DL/joint TCI state information is configured. |
| OPPO |  |  | In our understanding even this parameter is configured in BWP level the value corresponding to same SCS should be the same across BWPs within same cell. So we think this parameter is cell level parameter. So the best place should be in *ServingCellConfig*. |
| Samsung | Yes |  | According to RAN1 agreements, we think this BAT is only applied to the “CCs configured with the common TCI state ID update” so it should be configured per CC rather than per-CG (regarding FFS if parameter BeamAppTime is under the cell group config)  On Rel-17 DCI-based beam indication, regarding application time of the beam indication, the UE can assume that one beam application time (BAT) for a given SCS is configured for all the CCs configured with the common TCI state ID update,   * Note: It was agreed that the BAT associated with the carrier(s) (hence BWP(s)/CC(s)) on which the beam indication applies is determined based on the carrier with the smallest SCS among the carrier(s) (hence BWP(s)/CC(s)) applying the beam indication * TBD (maintenance): whether a second configured BAT is also supported, e.g. for MPUE or inter-cell BM * The detailed signaling of the BAT is up to RAN2 * FFS: For CC(s) not configured with a common TCI state ID update   Option 1 is fine to us and we share the view from Ericsson. |
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## 3.3 CORESET to follow Unified TCI state

The below agreement states how different coresets may assume different TCI state assumption.

**Agreement**

For Rel-17 unified TCI framework, on applying the indicated Rel-17 TCI state to PDCCH reception and the respective PDSCH reception:

* For discussion purposes, define as follows:
  + ‘CORESET A’: A CORESET other than CORESET#0 associated with only UE-dedicated reception on PDCCH in a CC, comprising CORESETs in association with:
    - [USS and/or CSS Type 3]
  + ‘CORESET B’: A CORESET other than CORESET#0 associated with only non-UE-dedicated reception on PDCCH in a CC, comprising CORESETs in association with:
    - [CSS or CSS other than Type 3]
  + ‘CORESET C’: A CORESET other than CORESET#0 associated with both UE-dedicated and non-UE-dedicated reception on PDCCH in a CC
  + CORESET#0
* For Rel-17 TCI state indication, support per CORESET determination as follows:
  + For any PDCCH reception on a ‘CORESET A’ and the respective PDSCH reception, UE always applies the indicated Rel-17 TCI state.
  + For any PDCCH reception on a ‘CORESET B’ and the respective PDSCH reception, whether or not UE to apply the indicated Rel-17 TCI state associated with the serving cell is determined per CORESET by RRC
    - FFS: For intra-cell BM, whether CORESET C is supported or not
  + If CORESET C is supported, the TCI state of CORESET C
    - FFS: For inter-cell BM, whether CORESET C is supported or not
  + If CORESET C is supported, the TCI state of CORESET C
    - FFS: The TCI state of CORESET 0

In RRC there is currently no concept of CORESET A or CORESET B, and there for CORESET C. Thus, a way to configure above behaviour for a CORESET in RRC is to enable Unified TCI state per CORESET. Any restrictions can be specified separately. ASN1 example is given as below:

#### – *ControlResourceSet*

The IE *ControlResourceSet* is used to configure a time/frequency control resource set (CORESET) in which to search for downlink control information (see TS 38.213 [13], clause 10.1).

***ControlResourceSet* information element**

-- ASN1START

-- TAG-CONTROLRESOURCESET-START

ControlResourceSet ::= SEQUENCE {

controlResourceSetId ControlResourceSetId,

frequencyDomainResources BIT STRING (SIZE (45)),

duration INTEGER (1..maxCoReSetDuration),

cce-REG-MappingType CHOICE {

interleaved SEQUENCE {

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

interleaverSize ENUMERATED {n2, n3, n6},

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

},

nonInterleaved NULL

},

precoderGranularity ENUMERATED {sameAsREG-bundle, allContiguousRBs},

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

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

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

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

...,

[[

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

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

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

controlResourceSetId-v1610 ControlResourceSetId-v1610 OPTIONAL -- Need S

]],

[[

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

--Editor’s note: Rel-17 DL TCI/joint state is enabled for this CORESET and tci-StatesPDCCH-ToAddList is not configured

]]

}

-- TAG-CONTROLRESOURCESET-STOP

-- ASN1STOP

Last round there was a discussion on why the added parameter, or marking would be on CORESET level while it seems to also depend on search space configuration.

CORESET is a frequency resource and search space gives the time and DCI assumption. For this not to be so straightforward it seems these configurations can be overlapping in freq/time. Thus it might not after all be so straightforward to know which level the followUnifiedTCIstae parameter should be configured.

For now, it has been agreed to implement the COREST level marking with editor’s note and discuss a question to RAN1 related to this configuration.

* 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).

RAN2 may decide to include question on this in the LS or wait for further input from RAN1

**Q3: Do you support asking about this from RAN1? If yes, please give suggested question**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Question to ask |
| Huawei, HiSilicon | Yes | RAN2 considers including a parameter, per CORESET, that indicates whether or not the UE shall apply Rel-17 TCI state indications when this CORESET is used with a common search space, or with any search space.  Would this satisfy RAN1 requirements/agreements?  If no, please explain what RAN1 requirement/agreement is not covered by such signalling. |
| Intel | Yes | We understand that the above RAN1’s agreement requires RRC signalling on CORESET B.  We can ask what is relationship of CORESET B and “DM-RS for non-UE dedicated PDCCH” in ApplyTCI-State-r17-DLList parameter.  In addition, we can ask how to define CORESET B to apply unified TCI state. |
| Ericsson | Yes | We should note them this parameter was not in their final excel but it was in the intermediate excel and RAN2 had noted the respective RAN1 agreements, based on which initial RAN2 discussions were conducted. As a question, we could simply state the currently concluded RRC signaling and ask whether this is enough and whether any restrictions are needed in addition, or if another signaling is suggested(if so to explain the functionality). |
| OPPO | Yes | To us it is clear that CORESET B need such marking. But for CORESET C which involving both UE dedicated reception and non-UE-dedicated reception is puzzling |
| Samsung | Yes | We also have same understanding with Intel which may following:   1. CORESET #N (associated with USS and/or CSS Type3) – No RRC signaling is required, only require the description either RAN1 (and)/or RAN2 specification. UE always applies the indicated Rel-17 TCI state. 2. CORESET #M (CSS or CSS other than Type 3) – RRC signaling indicates whether or not UE to apply the indicated Rel-17 TCI state e.g. 1 bit indicator.   RAN2 just ask whether this is enough or further support (e.g. FFS point for CORESET C) is required. |
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## 3.4 AP CSI-RS to follow Unified TCI state

Another aspect is how to configure possible aperiodic NZP CSI-RS resource or DMRS to follow the DL(or joint) unified TCI state.

|  |  |  |  |
| --- | --- | --- | --- |
| Ran2 parent IE | Param name | Description | Comment |
|  | ApplyTCI-State-r17-DLList | a list of the resource and/or resource set ID of the RS(s) which share the same indicated Rel-17 TCI state as UE-dedicated reception on PDSCH and for UE-dedicated reception on all or subset of CORESETs in a CC | Candidates include: AP-CSI-RS for BM, AP-CSI-RS for CSI, DL DMRS for non-UE-dedicated PDCCH/PDSCH from the serving cell.  Exact design including whether an explicit RRC parameter is needed or not is up to RAN2.  Applies only to Rel-17 unified TCI Framework |

The DMRS does not have an ID but DMRS is configured in PDSCH-config for PDSCH DMRS and PDCCH-Config for PDCCH DMRS. It is unclear why DMRS of PDSCH or DMRS PDCCH would not follow the TCI state configured for respective PDxCH. The related latest RAN1 agreements are:

**Agreement**

On Rel.17 unified TCI framework, discuss and decide by RAN1#106-e (August 2021)

* Whether each of the following DL RSs can share the same indicated Rel-17 TCI state as UE-dedicated reception on PDSCH and for UE-dedicated reception on all or subset of CORESETs in a CC
  + CSI-RS resources for CSI
  + Some CSI-RS resources for BM, if so, which ones (e.g. aperiodic, repetition ‘ON’)
  + CSI-RS for tracking
  + DMRS(s) associated with non-UE-dedicated reception on PDSCH and all/subset of CORESETs
* Whether some 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

**Agreement**

On Rel.17 unified TCI framework, for any DL RS that does not share the same indicated Rel-17 TCI state(s) as UE-dedicated reception on PDSCH and for UE-dedicated reception on all or subset of CORESETs in a CC, but can be configured as a target DL RS of a Rel-17 DL TCI (hence the Rel-17 DL TCI state pool), discuss and down-select by RAN1#106-e (August 2021) between the following two alternatives:

* Alt1. Rel-15/16 TCI state update signaling/configuration mechanism(s) are reused to update/configure the Rel-17 TCI state
* Alt2. Rel-17 TCI state update signaling/configuration mechanism(s) are used, e.g. with Rel-17 MAC-CE/DCI-based beam indication for Rel-17 joint/separate TCI

Note: The DL RS includes CSI-RS and DMRS for PDSCH or PDCCH

Note: For some channels/signals, only one of the above two alternatives may apply (to be discussed).

It remains unclear how DMRSs could be pointed to in a list of different TCI state from PDxCH is expected to be enabled. It is assumed this aspect will be clarified by RAN1.

Also the aperiodic NZP-CSI RS does not have an ID as such. Instead, the UE is configured with a list of aperiodic CSI-RS states where each consists of a set of CSI hypothesis. One CSI hypothesis consist of assumption on channel measurement and assumption on interference measurement where the latter may be CSI-IM(a window to inspect interference) or NZP CSI RS(an actual dedicated RS for interference measurement). Thus, there are two levels/options to easily indicate whether the aperiodic trigger state should assume Unified TCI state, or the TCI state configured specifically for the aperiodic trigger state.

The two levels are

* Option 1: at trigger state level, which means all CSI hypothesis follow unified TCI state.
* Option 2: per CSI hypothesis within a trigger state.

ASN1 code for both options is presented below

– *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,

... ,

[[

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

-- Editor’s note: OPTION 1: at trigger state level, which means all CSI hypothesis follow unified

-- TCI state is this is enabled

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

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}

CSI-AssociatedReportConfigInfo ::= SEQUENCE {

reportConfigId CSI-ReportConfigId,

resourcesForChannel CHOICE {

nzp-CSI-RS SEQUENCE {

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

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

OPTIONAL -- Cond Aperiodic

},

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

},

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

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

... ,

[[

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

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

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

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}

-- TAG-CSI-APERIODICTRIGGERSTATELIST-STOP

-- ASN1STOP

In last round of email discussion it was concluded that Option 2 is implemented and it is in the current running RRC CR.

**Proposal 6 Option 2 is implemented in running CR with editor’s note on FFS**

However, due to rapporteur’s hasty formulation of the proposal, we need another round..

* P6: Clarify which parameter is intended, resolve naming confusion, miáy be agreeable

**Proposal RAN2 to agree that “followUnifiedTCIstate-r17 ENUMERATED {enabled}” can be implemented in IE CSI-AssociatedReportConfigInfo as an optional parameter with editor’s note on FFS on placement**

**Q4: Do you agree with the reformulated proposal? In an Ls to RAN1, should RAN2 ask RAN1 whether they are ok with this outcome or inform RAN1 about the conclusion or neither is needed?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No about proposal | Comments on possible LS text |
| Huawei, HiSilicon | Not sure, see comment | According the "description" column in RAN1 excel sheet, if there would be a parameter, it would be in CSI-ResourceConfig or in NZP-CSI-RS-ResourceSet, not anywhere else. However, it is true that the "comment" column somehow contradicts with the "description" column.  If we send an LS to RAN1, we could point this contradiction in their excEricssonel sheet.  With respect to CSI-AssociatedReportConfigInfo:  - if the Rel-17 TCI framework is to be followed, the qcl-Info should be absent, while currently the qcl-Info must be present for aperiodic resources. Therefore, absence of qcl-Info could be sufficient to indicate that the Rel-17 TCI framework is to be followed for aperiodic resources.  - if RAN1 wishes some indication to apply also to periodic resources, absence of qcl-Info in NZP-CSI-RS-Config could imply that Rel-17 TCI framework is to be followed.  In any case, if a parameter is added that says that Rel-17 TCI indications are to be followed rather than qcl-Info, it should be specified that qcl-Info is absent. |
| Intel | See comment | To our understanding, followUnifiedTCIstate-r17 (a.k.a ApplyTCI-State-r17-DLList) needs to be defined for AP-CSI-RS for BM, AP-CSI-RS for CSI, DL DMRS for non-UE-dedicated PDCCH/PDSCH separately and defined per PDSCH-Config as RAN1 indicates “Per UE per cell per BWP”.  The example is:  ApplyTCI-State-r17-DLList  {                AP-CSI-RS for BM            ENUMERATED {enabled} OPTIONAL,  AP-CSI-RS for CSI             ENUMERATED {enabled} OPTIONAL,  DL DMRS for non-UE-dedicated PDCCH/PDSCH   ENUMERATED {enabled} OPTIONAL  }  One may ask who to define AP-CSI-RS for BM and AP-CSI-RS for CSI.  We understand that there is no separate configuration for CSI-RS for BM, CSI, TRS etc. It determined based on the following:  • If trsInfo is configured, then the AP-CSI-RS is TRS  • If trsInfo is not configured but “repetition” is configured, then AP-CSI-RS is for BM  • If trsInfo and repetition are not configured, then AP-CSI-RS is for CSI  Therefore, if we define a simple enabling parameter, PHY specification can take care of the mapping which AP-CSI-RS should be applied with TCI state.  For example,  if “AP-CSI-RS for BM” is enabled, TCI state of AP-CSI-RS not configured with trs-Info but “repetition” is configured follows unified TCI state.  We are ok to send an LS to RAN1 to check our understanding. |
| Ericsson | yes | In the excel there are three rows(16,17,26) that may be seen related as all are about unified TCI state and NZP-CSI-RS resource. The row 16 and 17 suggest to add Rel-17 TCI state ID in both NZP CSI-RS resource for periodic reporting as well as CSI-AssociatedReportConfigInfo. This is intended to be able to configure Rel-17 unified TCI state for the resources OTHER than what PDSCH/(PDCCH) uses. Additionally, row 26 is about indicating when AP CSI-RS should instead follow the beam of PDSCH/(PDCCH). The question here is only about row 26.  However, the in row 26 RAN1 suggest to have what is according to example provided by Intel. Issue is, RRC does not have “AP-CSI-RS for BM” or “AP-CSI-RS for CSI”. RRC has trigger states and there can be 128 of those. Depending on specific parameters within the trigger state, the AP CSI-RS can be either BM, CSI or TRS.  Thus, instead of starting to maintain toadmodlist in PDSCHConfig where two out of three kinds of trigger states could be added/removed, it is suggested to have “followunifiedTCIstate” parameter in the CSI-AssociatedReportConfigInfo. Certainly, if there is simpler working way as suggested by HW that absence of QCL “marks” the trigger state to have the followunifiedTCIstate then that can be adopted/discussed once the principle is agreed. Also, any naming fine tuning can be done. Perhaps followPDSCHTCIstate is more descriptive. |
| OPPO | See comments | We agree with Intel’s understanding in terms of the usage of CSI RS resource set. So it should be fine for current place holder since the new parameter is associated with a NZP-CSI-RS resource set, which can indicate whether it is for BM or CSI or TRS.  In addition the detail of TCI state per resource within resource set should be configured by RRC signaling i.e. the qcl-info should not be absent. In case unified TCI state is extended based on current TCI state, current qcl-info can be reused, whose TCI state id actually refers to one joint/DL TCI state.  In case aperiodic CSI RS need follow beam indication in DCI, then these TCI state ids can be absent. So we think current wording of the IE should be fine. |
| Samsung | Not sure | We share the view from Huawei that there are some uncertainties between the “description” column and “comment” column from RAN1 excel sheet.  First we need to know which description is correct in order that RAN2 know how this functionality is implemented in the ASN.1.  Based on RAN1 response, RAN2 will further determine how to signal this parameter(s):   * Under the CSI-ResourceConfig or in NZP-CSI-RS-ResourceSet; or * Under the CSI-AssociatedReportConfigInfo; or   New RRC IE |
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## 3.5 SRS follow unified TCI state

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| **RAN2 Parant IE** | **Description** | **Value Range** | **Comment** |
| ApplyTCI-State-r17forSRS | Whether all SRS resources in resource set(s) configured for antenna switching/codebook-based/non-codebook-based UL transmissions share the same indicated Rel-17 TCI state as dynamic-grant/configured-grant based PUSCH and all of dedicated PUCCH resources in a CC. This applies to the following: 1) Aperiodic SRS for BM, 2) SRS (of any time-domain behavior) for codebook, non-codebook, and antenna switching | {0,1}  See col P (comment from LG) | Exact design including whether an explicit RRC parameter is needed or not is up to RAN2.  Applies only to Rel-17 unified TCI Framework  Comment from LG: For the value range, it should be considered further for applying the indicated beam with configurability on SRS resource or resource set level instead of ON-OFF decision for all SRSs. Also, similar configuration parameters are required for other DL/UL target channels, e.g. for some CSI-RS resources, for some CORESETs, for some PUCCH resources, etc. |

Based on the input, it looks like a “followUnifiedTCIstate-r17 ENUMERATED {enabled} “ can be placed under SRSresourceSet as the following example:

SRS-ResourceSet ::= SEQUENCE {

srs-ResourceSetId SRS-ResourceSetId,

srs-ResourceIdList SEQUENCE (SIZE(1..maxNrofSRS-ResourcesPerSet)) OF SRS-ResourceId OPTIONAL, -- Cond Setup

resourceType CHOICE {

aperiodic SEQUENCE {

aperiodicSRS-ResourceTrigger INTEGER (1..maxNrofSRS-TriggerStates-1),

csi-RS NZP-CSI-RS-ResourceId OPTIONAL, -- Cond NonCodebook

slotOffset INTEGER (1..32) OPTIONAL, -- Need S

...,

[[

aperiodicSRS-ResourceTriggerList SEQUENCE (SIZE(1..maxNrofSRS-TriggerStates-2))

OF INTEGER (1..maxNrofSRS-TriggerStates-1) OPTIONAL -- Need M

]]

},

semi-persistent SEQUENCE {

associatedCSI-RS NZP-CSI-RS-ResourceId OPTIONAL, -- Cond NonCodebook

...

},

periodic SEQUENCE {

associatedCSI-RS NZP-CSI-RS-ResourceId OPTIONAL, -- Cond NonCodebook

...

}

},

usage ENUMERATED {beamManagement, codebook, nonCodebook, antennaSwitching},

alpha Alpha OPTIONAL, -- Need S

p0 INTEGER (-202..24) OPTIONAL, -- Cond Setup

pathlossReferenceRS PathlossReferenceRS-Config OPTIONAL, -- Need M

srs-PowerControlAdjustmentStates ENUMERATED { sameAsFci2, separateClosedLoop} OPTIONAL, -- Need S

...,

[[

pathlossReferenceRSList-r16 SetupRelease { PathlossReferenceRSList-r16} OPTIONAL -- Need M

]] ,

[[

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

]]

}

**Q5: Do companies agree with placing a “followUnifiedTCIstate-r17 ENUMERATED {enabled} “ under IE SRSresourceSet?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Huawei, HiSilicon | Yes if | that parameter is needed at all.  If it is possible to set this parameter when the SRS resource set refers to SRS resources that include the spatialRelationInfo field, then the parameter is needed.  Otherwise, absence of spatialRelationInfo in all SRS resources of a resource set might be sufficient to indicate that the Rel-17 TCI indications are to be followed to determine the spatial relation information. |
| Intel | Yes | This seems ok although in our contribution, we propose to define followUnifiedTCIstate-r17 per type of SRS (i.e. 1) Aperiodic SRS for BM, 2) SRS (of any time-domain behavior) for codebook, non-codebook, and antenna switching ).  We preferred to use the original RAN1 parameter name but can accept if rapporteur prefer the current name. But, could we add SRS (ie. followUnifiedTCIstateSRS-r17) to be aligned with RAN1 parameter list? |
| Xiaomi | Yes |  |
| Ericsson | yes |  |
| OPPO | Yes but | For periodic SRS and aperiodic SRS, per SRS resource set configuration is enough.  But for SP SRS can’t be addressed by RRC i.e. it could be done via MAC CE. |
| Samsung | Yes |  |
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**Q6: Do companies think similar parameter is needed for PUCCH? If so, should RAN2 ask about this from RAN1?**

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| --- | --- | --- |
| Company | Yes/No | Comment |
| Huawei, HiSilicon | No | At least, not based on this parameter. Of course, RAN1 can ask if they want. |
| Intel | No | Agree with Huawei |
| Ericsson | No | We can assume RAN1 brings it up if it is needed |
| OPPO | No |  |
| Samsung | No |  |
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## 3.6 UL power control framework for BM

For other UL power control parameters except for PL-RS (P0, alpha, closed loop index), a setting of P0, alpha, closed loop index can be associated per signal/channel. The excel seems to also give the option that one set is given that is common to all PUSCH, PUCCH and SRS. In addition, the excel suggest that an UL TCI state may be associate to a set (P0, alpha, closed loop index).

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| --- | --- | --- | --- | --- |
| **RAN2 Parant IE** | **Parameter name in the spec** | **Description** | **Per (UE, cell, TRP, …)** | **Comment** |
| PUSCH-PowerControl | p0\_Alpha\_CLIdPUSCHSet | UL PC parameters other than PLRS (Set of P0, alpha and closed loop index): PUSCH | Per UE per cell per BWP | It can be discussed in RAN2 whether a new parameter is needed or the associated legacy parameter can be reused. Or if one parameter that includes all UL PC setting (other than PLRS) pars can be used.  It was agreed that one setting can (optionally) be associated with an UL or if applicable joint TCI state via RRC. The details are up to RAN2  Applies only to Rel-17 unified TCI Framework  Up to RAN2 whether the ones for PUSCH, PUCCH, and SRS are combined into one structure (RAN1 thinks this can be done) |
| PUCCH-PowerControl | p0\_~~Alpha\_~~CLIdPUCCHSet | UL PC parameters other than PLRS (Set of P0, alpha and closed loop index): PUCCH | Per UE per cell per BWP | It can be discussed in RAN2 whether a new parameter is needed or the associated legacy parameter can be reused. Or if one parameter that includes all UL PC setting (other than PLRS) pars can be used  It was agreed that one setting can (optionally) be associated with an UL or if applicable joint TCI state via RRC. The details are up to RAN2  Applies only to Rel-17 unified TCI Framework  Up to RAN2 whether the ones for PUSCH, PUCCH, and SRS are combined into one structure (RAN1 thinks this can be done) |
| SRS-Config | p0\_Alpha\_CLIdSRSSet | UL PC parameters other than PLRS (Set of P0, alpha and closed loop index): SRS | Per UE per cell per BWP | It can be discussed in RAN2 whether a new parameter is needed or the associated legacy parameter can be reused. Or if one parameter that includes all UL PC setting (other than PLRS) pars can be used.  It was agreed that one setting can (optionally) be associated with an UL or if applicable joint TCI state via RRC. The details are up to RAN2  Applies only to Rel-17 unified TCI Framework  Up to RAN2 whether the ones for PUSCH, PUCCH, and SRS are combined into one structure (RAN1 thinks this can be done) |
| p0\_Alpha\_CLIdPUSCHSet  p0\_Alpha\_CLIdPUCCHSet  p0\_Alpha\_CLIdSRSSet | p0\_~~Alpha\_~~CLIdSetId | p0\_Alpha\_CLIdSet ID (Set of P0, alpha and closed loop index) | Per UE per cell per BWP | It can be discussed in RAN2 whether a new parameter is needed or the associated legacy parameter can be reused. Or if one parameter that includes all UL PC setting (other than PLRS) pars can be used.  It was agreed that one setting can (optionally) be associated with an UL or if applicable joint TCI state via RRC. The details are up to RAN2  Applies only to Rel-17 unified TCI Framework |

A related parameter is the pathloss reference refence signal

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **RAN2 Parant IE** | **Parameter name in the spec** | **Description** | **Per (UE, cell, TRP, …)** | **Comment** |
| [TCI-State\_r17 or new IE list for PLRS in PUSCH\_Config] | SourceRS-Info\_r17-PLRS | ~~Source RS and QCL Info definition for~~ Rel-17path-loss measurement RS (PL-RS) | Per UE per cell per BWP | Detailed design up to RAN2  Can be included in UL or Joint TCI if included in TCI state, or can be a separate list in PUSCH Config if associated. Detailed design is up to RAN2.  Applies only to Rel-17 unified TCI Framework |

**RAN1 agreed that:**

**Agreement**

On the setting of UL PC parameters except for PL-RS (P0, alpha, closed loop index) for Rel.17 unified TCI framework,

* For each of PUSCH and PUCCH, the setting of (P0, alpha, closed loop index) can be associated with UL or (if applicable) joint TCI state per BWP.
  + In this case, multiple settings are configured. Each setting can be associated with at least one TCI state, and, for a given TCI state, only one setting for PUSCH and only one setting for PUCCH can be associated at a time.
  + (Working Assumption) In this case, for each of the PUSCH and PUCCH, each of the activated UL or (if applicable) joint TCI states is associated with one of the settings.
* If not associated, for each of the PUSCH and PUCCH, the setting(s) of (P0, alpha, closed loop index) per channel/signal per BWP is independent of the UL or (if applicable) joint TCI states
* FFS: If the setting of (P0, alpha, closed loop index) for SRS can also be associated with UL or (if applicable) joint TCI state.
* FFS: (to be decided in RAN1#106-e) whether to configure the same setting of (P0, alpha, closed loop index) per TCI state across channels and apply a channel dependent component, or configure a channel dependent setting of (P0, alpha, closed loop index) per TCI state

Excel guides RAN2 to discuss and decide on the power control parameters thus it is checked whether RAN2 can converge on some aspects related to the power control design.

Last round companies were converging to have a common set of power control parameters for PUCCH, PUSCH and SRS and to configure that under BWP-UplinkDedicated. However, there seemed to be diverging input on this to this meeting and also rapporteur suggested to verify this understanding.

Even if there would be common IE to configure these the remaining question is that is it assumed that the UL channels share the same PO set (P0, alpha, closed loop index)

**Q7: Do companies assume that common PO set (P0, alpha, closed loop index), i.e. the same PO values, are shared for PUSCH, PUCCH and SRS?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Huawei, HiSilicon | No | as is visible from the Excel file from RAN1. |
| Intel | No | It should be different PO value but can be grouped as one IE group for unified TCI state.  For example,  p0\_Alpha\_CLIdSet  {  p0\_Alpha\_CLIdSetId  p0-AlphaSets for PUSCH  p0-AlphaSets for PUCCH  p0-AlphaSets for SRS  }  p0\_Alpha\_CLIdSet can be introduced in UL configuration level i.e. PUSCH Config  One remaining issue is how p0\_Alpha\_CLIdSetId is associated with actual uplink transmission because it is not associated with each UL TCI directly. If we follow Rel-16 operation, gNB configures the mapping between SRI and p0\_Alpha\_CLIdSet.  We suggest to ask RAN1 if SRI and p0\_Alpha\_CLIdSet mapping information should be configured |
| Ericsson | No | Our understanding is that SRI is to switch pathlossRS assumption for PUSCH. Now pathlossRS is in UL(or joint) TCI state and thus gets indicated. But ok to ask.  Current understanding for coding of the PO parameters is as such that   * pathlossRS is configured in UL TCI state which are configured in BWP-UL-Dedicated. * Then PO set(P0, alpha, closed loop index) is configured for each UL channel PUSCH, PUCCH, SRS in both UL TCI state as well as outside of UL TCI state(in BWP-UL-Dedicated).   + In both places bc RAN1 did not decide which way to go. Should then clarify that UE receives POset in UL TCI state or in BWP-UL-Dedicated |
| OPPO |  | The question is however bit misleading because it sounds like the power control parameters could be same for PUCCH, PUSCH and SRS. Our view is that network can configure a pool of PO(P0, alpha, closed loop index). Different index i.e. p0\_Alpha\_CLIdSetId can be referred by PUCCH, PUSCH and SRS to enable different configuration. These 3 index can be associated with one UL TCI state or joint TCI state. here is one example:  UL-TCIState ::= SEQUENCE {  ul-tciState-r17 TCI-State,  puschpPowerControlSetId-r17 p0\_Alpha\_CLIdSet ID-r17  pucchPowerControlSetId-r17 p0\_Alpha\_CLIdSet ID-r17  srsPowerControlSetId-r17 p0\_Alpha\_CLIdSet ID-r17  plr-RS-Id-r17 PUSCH-PathlossReferenceRS-Id,  }    UL-PC-Set-r17 ::= SEQUENCE {  p0\_Alpha\_CLIdSet ID INTERGER(1..max-p0\_Alpha\_CLIdSet ID),  p0-r17 INTEGER (-16..15) OPTIONAL, -- Need S  alpha-r17 Alpha OPTIONAL, -- Need S  pusch-ClosedLoopIndex-r17 ENUMERATED { i0, i1 }  } |
| Samsung | No | We share the understanding from Ericsson above. |
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# 4 mTRP

## 4.1 UL power control framework for FR1 mTRP

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| **Parameter name in the spec** | **New existing?** | **Description** | **Value range** |
| FFS: PUCCH-SpatialRelationInfo (without referenceSignal) or PUCCH-PowerControlSetInfo (new IE) | RAN2 to decide reusing of PUCCH-SpatialRelationInfo (without referenceSignal) | To support per-TRP power control in FR1, a new MAC-CE is used to link PUCCH resource with two power control parameter sets, and the MAC-CE shall indicate RRC IE that configures power control parameter sets (p0, pathloss RS ID, and a closed-loop index). RAN1 agreed that the exact design of RRC IE is up to RAN2 (from RAN1 point of view, one possible example is to reuse PUCCH-SpatialRelationInfo except for the referenceSignal).  Note: per-TRP’ refer to ‘per spatial relation (in FR2)’ or ‘per power control parameter set (in FR1)’ for PUCCH. | same as Rel-16 PUCCH-SpatialRelationInfo without referenceSignal. |

What needs to be enhanced according to the above RAN1 agreement as well as the RAN1 input for MAC CEs, is to link a PUCCH resource with either one or two power control parameter sets for FR1.

There is no need to configure spatial relations to a UE in FR1. For this reason, it may not be a good idea to reuse the PUCCH-spatialRelationsInfo to configure the power control parameter sets. The power control and spatial relation are separate functionality, it is cleaner to have separate configuration for PUCCH power control. This is true even if FR1 would use spatial relations.

However, in either case, it is not clear from the input that how many power control parameter sets (p0, pathloss RS ID, and a closed-loop index) should be configured per TRP.

**Q8: Do companies agree to have separate configuration for PUCCH power control for FR1 mTRP?**

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| --- | --- | --- |
| Company | Yes/No | Comment |
| Huawei, HiSilicon | Yes | It would be cumbersome to use an ASN.1 structure with mandatory parameters that are always to be ignored by the UE.  It is up to RAN2 to make choices for proper ASN.1 design. |
| Intel | Yes | Majority in RAN1 thinks that there is no issue to reuse PUCCH-SpatialRelationInfo. However, referenceSignal is mandatory field in PUCCH-SpatialRelationInfo. If we reuse PUCCH-SpatialRelationInfo , either the UE should ignoree referenceSignal or new IE should be introduced.  PUCCH-PowerControlSetInfo (new IE) should be introduced to configure power control parameter sets (p0, pathloss RS ID, and a closed-loop index). |
| Ericsson | yes | Agree with Intel about the new IE. |
| OPPO | comments | The same issue is discussed in email “[AT116bis-e][060][feMIMO] MAC general (Samsung)” and redundant discussion should be avoided. In short we support to reuse existing PUCCH-SpatialRelationInfo |
| Samsung | Yes | Re-using the legacy RRC IE for FR1 makes more confusion in terms of functionality because FR1 don’t define spatial relations.  In addition, handling of mandatory field in legacy RRC IE (i.e. ignore if UE receive this field) is not preferred for both NW and UE implementation. |
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**Q9: How many power control sets should be configured per TRP for PUCCH or should RAN2 ask this from RAN1?**

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| --- | --- | --- |
| Company | Nro | Comment/question to Ran1 |
| Huawei, HiSilicon | Ask RAN1 |  |
| Intel |  | We need to ask or wait for RAN1’s outcome. RAN1 is still under discussion how many TRPs can be configured/supported. |
| Ericsson |  | Safer to ask as otherwise they may forget to inform about this |
| OPPO |  | Ask RAN1 |
| Samsung |  | Ask RAN1 |
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## 4.2 SRI mapping for PUSCH for mTRP

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| --- | --- | --- |
| **RAN2 Parant IE** | **Description** | **Value Range** |
| FFS: sri-PUSCH-MappingToAddModList2 or sri-resource-setId | Agreement  When SRS resources from two SRS resource sets indicated in DCI format 0\_1/0\_2, for linking SRI fields to two power control parameters, it is up to RAN2 to finalize the RRC details related to linking. RAN1 identified that the following options could be used.  • Alt. 1: Add second sri-PUSCH-MappingToAddModList, and select two SRI-PUSCH-PowerControl from two sri-PUSCH-MappingToAddModList  • Alt. 2: Add SRS resource set ID in SRI-PUSCH-PowerControl, and select SRI-PUSCH-PowerControl from sri-PUSCH-MappingToAddModList considering the SRS resource set ID | sri-PUSCH-MappingToAddModList2 : same as sri-PUSCH-MappingToAddModList |

For supporting PUSCH power control for the second TRP RAN1 is considering two configuration options:

* Alt. 1: Add second sri-PUSCH-MappingToAddModList, and select two SRI-PUSCH-PowerControl from two sri-PUSCH-MappingToAddModList
* Alt. 2: Add SRS resource set ID in SRI-PUSCH-PowerControl, and select SRI-PUSCH-PowerControl from sri-PUSCH-MappingToAddModList considering the SRS resource set ID

ASN1 perspective it is easier to add the second list as the IE SRI-PUSCH-PowerControl is not extendable. This is currently adopted in the running RRC CR. It should be further noted that handling of the ID space and designing of the corresponding MAC CE have dependency here.

**Q10: Which Alternative is supported by the company?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Alt 1 | Alt2 | Comment |
| Huawei, HiSilicon | Yes | No | It seems a little simpler |
| Intel | Yes | No | During RAN1 discussion, Alt-1 was the majority opinion in RAN1 but the agreement could not be made by strong concern and pushed this decision to RAN2.  Alt-1 is straightforward in the sense that two SRIs are indicated in DCI format and each SRI is associated to sri-PUSCH-MappingToAddModList and sri-PUSCH-MappingToAddModList2.  It is not so clear if we need to introduce addition “SRS resource set ID” and how it will be considered in one list to differentiate two different SRS resource sets.  We prefer to add second sri-PUSCH-MappingToAddModList, and select two SRI-PUSCH-PowerControl from two sri-PUSCH-MappingToAddModList. |
| Ericsson | yes | no | simpler |
| OPPO | Yes |  |  |
| Samsung | Yes |  |  |
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# 5 CodebookConfig-r17

There is CodebookConfig related input from both CSI-FDD and CSI-mTRP subfeature groups.

The new CB from CSI-FDD is simple and translates into ASN1 like this(within new CodebookConfig-r17):

Type2 SEQUENCE {

typeII-PortSelection-r17 SEQUENCE {

paramCombination-r17 INTEGER (1..8),

valueOfN-r17 ENUMERATED{n2, n4},

typeII-PortSelectionRI-Restriction-r17 BIT STRING (SIZE (4))

}

}

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter name in the text** | **Description** | **Value** | **Comment** |
| codebookType | Support new codebook type, Rel-17 type II PS coodebook, as additional candidate value | new value:  {typeII-PortSelection-r17} |  |
| paramCombination-r17 | Field describes supported parameter combination {M, alpha, beta} for Rel-17 Type II PS codebook | INTEGER (1..8), | With regarding to parameter combinations, 8 parameter combinations of {M,α,β} are supported in Rel-17 PS codebook with following restrictions:  •Combinations with α=3/4 are not configurable with 4 and 12 Tx ports  •Combinations {M,α,β} = {2,1,3/4} and {2,1,1/2} are not configurable with 32 Tx ports |
|  |  |  |  |
|  |  |  |  |
| valueOfN | Field describes the size of the window of FD bases for Rel-17 Type II PS codebook. When M=2, N=2 or 4 | {2,4} | Proposal 12: In addition to N=2, N=4 is supported when M=2 for rank 1/2  • For rank 3/4, when M=2, N = 2 or 4 is supported and same with the value of N configured for rank 1/2 |
| typeII-PortSelectionRI-Restriction-r17 | Field describes the applicable ranks that the UE can report for rank 1~4. | BIT STRING (SIZE (4)) |  |

Unfortunately, the input from CSI-mTRP is not very descriptive:

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter name in the text** | **Description** | **Value** | **Comment** |
|  | Two RI restrictions can be configured per CodebookConfig, whereas one RI restriction is applied to all Single-TRP measurement hypotheses (up to the maximal rank of 8) and another one is applied to all NCJT measurement hypotheses (up to 4 rank combinations). | Up to RAN2 | Support the indication of following RI combinations by a joint RI field for a NCJT measurement hypothesis in CSI part 1, when the maximal transmission layers is less than or equal to 4:  • {1, 1}, {1, 2}, {2,1}, {2,2} |
|  | Two CBSRs can be configured per CodebookConfig, whereas one CBSR is applied to one CMR group in a CMR resource set respectively. | Up to RAN2 | For a CSI report associated with a Multi-TRP/panel NCJT measurement hypothesis configured by single CSI reporting setting: |
|  |  |  | • Two CBSRs can be configured per CodebookConfig, whereas one CBSR is applied to one CMR group in a CMR resource set respectively, i.e. per TRP. |
|  |  |  |  |

Thus the instruction is to configure codebook subset restriction (CBSR) per TRP but it does not tell much on the details. Something can be deduced on the RI restrictions. Rapporteur’s understanding is that the particular CBSR is the Rel-15 type 1 single panel CB.

The total ASN1 for CodebookConfig-r17 could look something like when following the structure and style of the existing CodebookConfigs:

CodebookConfig-r17 ::= SEQUENCE {

codebookType CHOICE {

type1 SEQUENCE {

typeI-SinglePanel1-r17 SEQUENCE {

nrOfAntennaPorts CHOICE {

two SEQUENCE {

twoTX-CodebookSubsetRestriction1-r17 BIT STRING (SIZE (6))

},

moreThanTwo SEQUENCE {

n1-n2 CHOICE {

two-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (8)),

two-two-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (64)),

four-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (16)),

three-two-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (96)),

six-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (24)),

four-two-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (128)),

eight-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (32)),

four-three-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (192)),

six-two-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (192)),

twelve-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (48)),

four-four-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (256)),

eight-two-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (256)),

sixteen-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (64))

},

typeI-SinglePanel-codebookSubsetRestriction1-i2-r17 BIT STRING (SIZE (16)) OPTIONAL -- Need R

}

},

typeI-SinglePanel-ri-Restriction2-r17 BIT STRING (SIZE (8))

},

typeI-SinglePanel2-r17 SEQUENCE {

nrOfAntennaPorts CHOICE {

two SEQUENCE {

twoTX-CodebookSubsetRestriction2-r17 BIT STRING (SIZE (6))

},

moreThanTwo SEQUENCE {

n1-n2 CHOICE {

two-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (8)),

two-two-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (64)),

four-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (16)),

three-two-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (96)),

six-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (24)),

four-two-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (128)),

eight-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (32)),

four-three-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (192)),

six-two-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (192)),

twelve-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (48)),

four-four-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (256)),

eight-two-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (256)),

sixteen-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (64))

},

typeI-SinglePanel-codebookSubsetRestriction2-i2-r17 BIT STRING (SIZE (16)) OPTIONAL -- Need R

}

},

typeI-SinglePanel-ri-Restriction2-r17 BIT STRING (SIZE (4))

}

Type2 SEQUENCE {

typeII-PortSelection-r17 SEQUENCE {

paramCombination-r17 INTEGER (1..8),

valueOfN-r17 ENUMERATED{n2, n4},

typeII-PortSelectionRI-Restriction-r17 BIT STRING (SIZE (4))

}

}

}

}

Open questions are at least:

* are both 2Tx and more than 2Tx supported for both CBSR?
* Is RI restriction configured per CBSR or are two RI restrictions, one 4 and one 8 bit configured for the pair?

**Q11: Do companies agree with the presented example and the open questions? Please state further questions if any**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Ericsson | See comment | Our current understanding is that the code is ok with the yellow updates and we could ask whether Ran1 is ok with this with below added field descriptions:  Change name of *typeI-SinglePanelSDMP, typeI-SinglePanelSDMP2* to *typeI-SinglePanel1, typeI-SinglePanel2* and have field description for *typeI-SinglePanel1, typeI-SinglePanel2* would say that network selects same restriction bitmap for both fields.  Change the name of *typeI-SinglePanel-ri-RestrictionSDMP-r17* to *typeI-SinglePanel-ri-Restriction1-r17* as it works same way as in Rel-15 and could have the following field description: Restriction for RI for TypeI-SinglePanel-RI-Restriction1 (see TS 38.214 [19], clause 5.2.2.2.1), when the reported CSI parameters correspond to one NZP CSI-RS resource from one Resource Group as defined in TS 38.214 [X], clause 5.2.1.4.2.  Change name of *typeI-SinglePanel-ri-RestrictionSDMP2-r17* to *typeI-SinglePanel-ri-Restriction2-r17*  And describe: "A pair of RI restrictions for *SinglePanel-RI-Restriction2* when the reported CSI parameters correspond to two NZP CSI-RS resources respectively from the first and second Resource Groups as defined in TS 38.214 [X], clause 5.2.1.4.2"  Then we should have field descriptions for the bitmaps similar to:  *n1-n2-codebookSubsetRestrition within typeI-SinglePanel1-r17*:  “Number of antenna ports in first (n1) and second (n2) dimension and codebook subset restriction associated with a NZP CSI-RS resource from a first Resource Group as defined in TS 38.214 [X], clause 5.2.1.4.2  *n1-n2-codebookSubsetRestrition within typeI-SinglePanel2-r17*:  “Number of antenna ports in first (n1) and second (n2) dimension and codebook subset restriction associated with a NZP CSI-RS resource from a second Resource Group as defined in TS 38.214 [X], clause 5.2.1.4.2 |
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# 6 Other

In SRSConfig, it was noticed that there is potentially one parameter missing as there was no r17 counterpart for *startPosition-r16*:

[[

resourceMapping-r16 SEQUENCE {

startPosition-r16 INTEGER (0..13),

nrofSymbols-r16 ENUMERATED {n1, n2, n4},

repetitionFactor-r16 ENUMERATED {n1, n2, n4}

} OPTIONAL -- Need R

]]

,

[[

resourceMapping-r17 SEQUENCE {

nrofSymbols-r17 ENUMERATED {n8, n10, n12, n14},

repetitionFactor-r17 ENUMERATED {n1, n2, n4, n5, n6, n7, n8, n10, n12, n14}

}

**Q12: Do companies agree to ask from RAN1 whether this parameter should be there also in Rel-17?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Ericsson | yes | Based on our understanding it would be needed also in Rel-17 thus we suggest to ask RAN1 |
| Samsung | Yes | Ask to RAN1 for this parameter, it is strange to remove the configuration of this parameter in R17. |
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# 7 Conclusion

**TBA**

# 8 Appendix

RAN2 agreements 116bis

[R2-2201560](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116bis-e\Docs\R2-2201560.zip) Running RRC CR for FeMIMO Rel-17 Ericsson draftCR Rel-17 38.331 16.7.0 NR\_feMIMO-Core Late

- has implemented all L1 parameter, except the one under discussion and with FFSes from R1.

* Review offline
* 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

[Mon Not Finished]

RAN2 agreements 116

[R2-2110666](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2110666.zip) Running RRC CR for FeMIMO Rel-17 Ericsson draftCR Rel-16 38.331 16.6.0 NR\_feMIMO-Core

* Endorsed as baseline (last meeting agreements included). Comments to be incorporated in CR after the meeting.

[R2-2110960](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2110960.zip) MAC Running CR for Rel-17 feMIMO Samsung draftCR Rel-17 38.321 16.6.0 B NR\_feMIMO-Core Late

* Endorsed as baseline (last meeting agreements included). Comments to be incorporated in CR after the meeting.

RAN2 impacts of inter-cell beam mgmt

[R2-2110341](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2110341.zip) On Rel-17 FeMIMO Ericsson discussion NR\_feMIMO-Core

DISCUSSION

- Samsung think there are ongoing discussions in R1. UL could be common or separate.

- MTK support this proposal. Think that what could make it complex is if we have to mix both R16 and R17 new frameworks for one UE.

- Chair proposes a high level text. OPPO want to wait. CATT think we can agree on a high level.

* RAN2 to support separate DL and UL and joint TCI state configurations. Details FFS.
* [AT116-e][015][feMIMO] (Nokia [lead], Ericsson, vivo)

Scope: On RAN1 LSes [R2-2111214](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2111214.zip), [R2-2111246](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2111246.zip), [R2-2109326](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2109326.zip) and their General and high level consequences. Review impacts to RRC (top down) and R2 work, e.g. general observations, structure, common impacts and impact specific to mTRP and MCBF - Find Easy/Potential Agreements, identify points for online discussion, can also identify and capture open issues, and whether LS out is needed. (Comment: please focus on points that need to be discussed/decided to pave the way for more detailed later discussions).

Intended outcome: Report

Deadline: For online W2 Wednesday

* 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.
* [AT116-e][016][feMIMO] MAC CE impacts (Samsung)

Scope: Based on [R2-2110962](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2110962.zip), [R2-2110035](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2110035.zip), RAN LS’s and RAN1 progress. Do an initial review of impacts to MAC (MAC CEs) and related R2 work, collect initial comments, assess maturity and if possible Find Potential Agreements, identify points for online discussion, can also identify open issues.

Intended outcome: Report

Deadline: For online W1 Thursday, CLOSED

* 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.
* [AT116-e][017][feMIMO] BFD BFR and Initial Running CRs (Samsung)

Scope: 1) Review the submitted Running CRs in [R2-2110666](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2110666.zip) (RRC) and [R2-2110960](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2110960.zip) (MAC), collect comments with the goal of endorsement, save comments to be applied to the CRs after this meeting. 2) Treat the proposals in BFD BFR tdocs under AI 8.17.3, identify agreeable points, points for discussion, identify open issues, whether LS out is needed etc.

Intended outcome: Report

Deadline: W2 Wednesday.

CLOSED

* All green-marked proposals are agreed, see below. For Running CR endorsement see R2-2110666 and R2-2110960.
* 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.