**3GPP TSG-RAN WG1 Meeting #116  R1-231xxxx**

**Athens, Greece, February 26-March 1, 2024**

**Agenda Item: 8.4**

**Source: Moderator (Huawei)**

**Title: FLS#1 for maintenance of SD-PD adaptation R18 NES**

**Document for: Discussion and decision**

# Introduction

This document contains discussion summarized for spatatial and power domain adaptataion for R18 NES.

# Recommandation for online

[Tbd]

# Discussion

1. **Part 2 CSI omission**

As one pending issue, whether or not the current specification already supports Part 2 wideband CSI omission at a sub-report level caused discussion in the last meeting. No consensus was made. In this meeting, the following companies provide view and TPs for further clarification: Huawei, Nokia, vivo, CATT, ZTE, xiaomi, Samsung, Apple, LGe. All proponents from this meeting consider that Part 2 wideband CSI sub-report shall be dropped together with legacy CSI report, as legacy omission rule, and one of them consider no spec impact is needed for the above understanding.

Given that potential ambiguity exits, some calrification seems needed. Therefore, the following TP#1 based on Apple’s version is proposed.

**###### Proposal**

**Adopt the following TP for TS 38.214:**

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| **TP#1 for TS38.214**  **Reason for change:** There is ambiguity on whether the current spec supports sub-configuration level of Part 2 wideband CSI omission. |
| **Summary of change:** Omission of Part 2 wideband CSI when needed, is done as legacy in report level. Only Part subband CSI is dropped in sub-configuration level. |
| **Consequences if not approved:**UE omission behaviour for Part 2 WB CSI is unclear and unnecessarily complicated, if it is interpreted as supported. |
| -----------------------------------------------------------Text proposal -----------------------------------------------------------  5.2.3 CSI reporting using PUSCH  <Unchanged parts omitted>  When CSI reporting on PUSCH comprises two parts, the UE may omit a portion of the Part 2 CSI. Omission of Part 2 CSI is according to the priority order shown in Table 5.2.3-1, where  is the number of CSI reports configured to be carried on the PUSCH. Priority 0 is the highest priority and priority  is the lowest priority and the CSI report *n* corresponds to the CSI report with the *n*th smallest Prii,CSI(*y,k,c,s*) value among the  CSI reports as defined in Clause 5.2.5. The subbands for a given CSI report *n* indicated by the higher layer parameter *csi-ReportingBand* with value '1' are numbered continuously in increasing order with the lowest subband of *csi-ReportingBand* with value set to '1' as subband 0. When omitting Part 2 CSI information for a particular priority level, the UE shall omit all of the information at that priority level, except for Part 2 subband CSI when the corresponding CSI report contains one or more CSI sub-reports with Part 2 each corresponding to a sub-configuration from a list of sub-configurations provided by *csi-ReportSubConfigList* contained in the *CSI-ReportConfig* as described in Clause 5.2.1.1.  ......  - For a Reporting Setting for which the *CSI-ReportConfig* contains a list of sub-configurations provided by [*csi-ReportSubConfigList*], for a corresponding CSI report which contains one or more CSIs sub-reports, omission of Part 2 subband CSI is done at a sub-configuration level within the same priority level defined by Table 5.2.3-1 where a sub-configuration with an index, provided by [*csi-ReportSubConfigID*], with lower value has higher priority.  <Unchanged parts omitted>  -------------------------------------------------------End of Text proposal ------------------------------------------------------ |

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| **Company** | **Comments** |
| **Samsung** | Okay with FL’s proposal. |
| **LG Electronics** | Support the proposal. |
| **Spreadtrum** | OK |
| **ZTE, Sanechips** | OK with the proposal. |
| **Fujitsu** | Support the proposal. |
| **CATT** | OK |
| **Apple** | Support |
| **Xiaomi** | Support |
| **Huawei, HiSilicon** | OK. |
| **Google** | Support |
| **vivo** | Support |

Another issue raised by LGe is that the sub-band CSI omission at sub-config level is not properly implemented in TS 38.213.

**###### Proposal**

**Adopt the following TP for TS 38.213:**

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| **TP#1-1 for TS38.213**  **Reason for Change:**   * Whether sub-configuration level omission is supported or not for Part 2 CSI is unclear, however it should be supported as agreed in RAN1 and implemented in other specifications.   **Summary of Change:**   * Sub-configuration level CSI omission for Part 2 CSI is supported.   **Consequences if not approved:**   * Unclear UE behavior to perform omission of CSI corresponding to a CSI report configuration containing a list of sub-configurations.   9.2.5.2 UE procedure for multiplexing HARQ-ACK/SR/CSI in a PUCCH  For a transmission occasion of a single CSI report, a PUCCH resource is provided by *pucch-CSI-ResourceList*. For a transmission occasion of multiple CSI reports, corresponding PUCCH resources can be provided by *multi-CSI-PUCCH-ResourceList*. If a UE is provided first and second *PUCCH-Config*, *multi-CSI-PUCCH-ResourceList* is provided by the first *PUCCH-Config*, and *PUCCH-ResourceId* in *pucch-CSI-ResourceList* or *multi-CSI-PUCCH-ResourceList* indicates a corresponding PUCCH resource in *PUCCH-Resource* provided by the first *PUCCH-Config*.  If a UE is provided only one PUCCH resource set for transmission of HARQ-ACK information in response to PDSCH reception scheduled by a DCI format or in response to a DCI format having associated HARQ-ACK information without scheduling PDSCH reception, the UE does not expect to be provided *simultaneousHARQ-ACK-CSI*.  A UE is configured by *maxCodeRate* a code rate for multiplexing HARQ-ACK, SR, and CSI report(s) in a PUCCH transmission using PUCCH format 2, PUCCH format 3, or PUCCH format 4.  If a UE transmits CSI reports using PUCCH format 2, the UE transmits only wideband CSI for each CSI report [6, TS 38.214]. In the following, a Part 1 CSI report refers either to a CSI report with only wideband CSI or to a Part 1 CSI report with wideband CSI and sub-band CSI.  For the purposes of this clause, Part 2 CSI sub-reports [6, TS 38,214], if any, are considered as Part 2 CSI reports. |

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| **Company** | **Comments** |
| **Samsung** | We are open to discuss this issue. However, the proposed CR is unclear and cannot reflect sub-configuration level CSI omission on PUCCH. |
| **LG Electronics** | Support the proposal. |
| **ZTE, Sanechips** | We think it can be discussed after the first **TP for TS 38.214** is clear. |
| **Fujitsu** | We are general fine with this proposal. We agree that sub-configuration level omission should be captured by 38.213. |
| **CATT** | This is not a necessary correction |
| **Huawei, HiSilicon** | It is additional clarification which seems has no strong motivation. But it is ok for us to addional clarification. |
| **Google** | We would like to understand the potential ambiguity without the change. |
| **vivo** | We are open to discussion the issue for more clear clarification |

1. **CSI reference resource definition and relevant dropping**

Regarding the following agreement made in RAN1#115, several relevant issues are identified by Google, ZTE, Apple, LGe.

***Agreement***

*For a CSI report configuration containing a list of sub-configurations, after the CSI report (re)configuration, serving cell activation, BWP change, or activation of SP-CSI, the UE reports a CSI report including one or more sub-reports only after receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement, per sub-configuration, no later than CSI reference resource and drops the report otherwise.*

*For the above “per sub-configuration”, it is a sub-configuration that is*

* *Alt 1: the activated/triggered one for SP-CSI reporting*

One issue raised by Google is to clarify the definition of CSI reference resource for SP-CSI reporting: whether the counting of the total number of CSI-RS resources for CM is based on all triggered sub-cofigurations or configured sub-configurations.

The second issue discussed by LGe, Apple is to clarify the case for P- and AP-CSI reporting in addition to the agreement, where for P-CSI reporting a sub-configuration is the configured sub-configuration. ZTE mentioned that P-CSI reporting is not calrified and in their TP it seems P-CSI reporting is excluded simply, if I understand it correctly.

A third issue discussed by ZTE and LGe is to take into account the interaction with C-DRX, with UE behaviour largely following legacy.

Considering all the provided TPs, following is generated for discussion.

**###### Proposal**

**Discuss the following TP for adoption for TS38.214.**

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| 5.2.2.5 CSI reference resource definition The CSI reference resource for a serving cell is defined as follows:  - In the frequency domain, the CSI reference resource is defined by the group of downlink physical resource blocks corresponding to the band to which the derived CSI relates.  - In the time domain, the CSI reference resource for a CSI reporting in uplink slot *n'* is defined by a single downlink slot *,* where is a parameter configured by higher layer as specified in clause 4.2 of [6 TS 38.213], and where is the subcarrier spacing configuration for with a value of 0 for frequency range 1,  - where  and and  are the subcarrier spacing configurations for DL and UL, respectively, and and  are determined by higher-layer configured ca-SlotOffset for the cells transmitting the uplink and downlink, as defined in clause 4.5 of [4, TS 38.211]  - where for periodic and semi-persistent CSI reporting  - if a single CSI-RS/SSB resource is configured for channel measurement *nCSI\_ref* is the smallest value greater than or equal to , such that it corresponds to a valid downlink slot, or  - if multiple CSI-RS/SSB resources are configured for channel measurement *nCSI\_ref* is the smallest value greater than or equal to , such that it corresponds to a valid downlink slot  - The CSI-RS resources above are counted based on the total number of CSI-RS resources for channel measurement across the triggered sub-configurations for a semi-persistent CSI report.  --omitted—  After the CSI report (re)configuration, serving cell activation, BWP change, or activation of SP-CSI, the UE reports a CSI report only after receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement no later than CSI reference resource and drops the report otherwise. For a CSI report configuration containing a list of sub-configurations provided by *csi-ReportSubConfigList*, after the CSI report (re)configuration, serving cell activation, BWP change, or activation of SP-CSI, the UE reports a CSI report including one or more sub-reports only after receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement, per sub-configuration, no later than CSI reference resource and drops the report otherwise, where the sub-configuration is the activated/triggered one(s) for AP/SP-CSI reporting, or the configured ones for P-CSI reporting.  --omitted—  When DRX is configured, the UE reports a CSI report only if receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement in DRX Active Time no later than CSI reference resource and drops the report otherwise. When DRX is configured, for a CSI report configuration containing a list of sub-configurations provided by *csi-ReportSubConfigList*, UE reports a CSI report including one or more sub-reports only if receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement in DRX Active Time, per sub-configuration, no later than CSI reference resource and drops the report otherwise, where the sub-configuration is the activated/triggered one(s) for AP/SP-CSI reporting, or the configured ones for P-CSI reporting. When the UE is configured to monitor DCI format 2\_6 and if the UE configured by higher layer parameter *ps-TransmitOtherPeriodicCSI* to report CSI with the higher layer parameter *reportConfigType* set to 'periodic' and *reportQuantity* set to quantities other than 'cri-RSRP', 'ssb-Index-RSRP', 'cri-RSRP- Index', and 'ssb-Index-RSRP- Index ' when *drx-onDurationTimer* is not started, the UE shall report CSI during the time duration indicated by *drx-onDurationTimer* in *DRX-Config* also outside active time according to the procedure described in Clause 5.2.1.4 if receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement during the time duration indicated by drx-onDurationTimer in *DRX-Config* outside DRX active time or in DRX Active Time no later than CSI reference resource and drops the report otherwise. For a CSI report configuration containing a list of sub-configurations provided by *csi-ReportSubConfigList*, when the UE is configured to monitor DCI format 2\_6 and if the UE configured by higher layer parameter *ps-TransmitOtherPeriodicCSI* to report CSI with the higher layer parameter *reportConfigType* set to 'periodic' and *reportQuantity* set to quantities other than 'cri-RSRP', 'ssb-Index-RSRP', 'cri-RSRP- Index', and 'ssb-Index-RSRP- Index' when *drx-onDurationTimer* is not started, UE shall report a CSI report including one or more sub-reports only during the time duration indicated by *drx-onDurationTimer* in *DRX-Config* also outside active time according to the procedure described in Clause 5.2.1.4 if receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement during the time duration indicated by drx-onDurationTimer in *DRX-Config* outside DRX active time or in DRX Active Time, per sub-configuration, no later than CSI reference resource and drops the report otherwise, where the sub-configuration is the activated/triggered one(s) for AP/SP-CSI reporting, or the configured ones for P-CSI reporting. When the UE is configured to monitor DCI format 2\_6 and if the UE configured by higher layer parameter *ps-TransmitPeriodicL1-RSRP* to report L1-RSRP with the higher layer parameter *reportConfigType* set to 'periodic' and *reportQuantity* set to 'cri-RSRP', 'ssb-Index-RSRP', 'cri-RSRP- Index', or 'ssb-Index-RSRP- Index' when *drx-onDurationTimer* is not started, the UE shall report L1-RSRP during the time duration indicated by *drx-onDurationTimer* in *DRX-Config* also outside active time according to the procedure described in clause 5.2.1.4 and when reportQuantity set to 'cri-RSRP' or *'*cri-RSRP- *Index*' if receiving at least one CSI-RS transmission occasion for channel measurement during the time duration indicated by drx-onDurationTimer in *DRX-Config* outside DRX active time or in DRX Active Time no later than CSI reference resource and drops the report otherwise.  For the CSI report configuration in CSI-*ReportConfig* associated with the higher layer parameter *reportQuantity* comprising at least 'RI' on a serving cell with cell DTX activated [10, TS 38.321], the UE reports a CSI report only if receiving at least one CSI-RS transmission occasion of each periodic CSI-RS resource or semi-persistent CSI-RS resource for channel measurement and/or interference measurement in active periods of cell DTX no later than CSI reference resource, and the UE drops the CSI report otherwise. For a CSI report configuration containing a list of sub-configurations provided by *csi-ReportSubConfigList* on a serving cell with cell DTX activated [10, TS 38.321], UE reports a CSI report including one or more sub-reports only if receiving at least one CSI-RS transmission occasion of each periodic CSI-RS resource or semi-persistent CSI-RS resource for channel measurement and/or interference measurement in active periods of cell DTX , per sub-configuration, no later than CSI reference resource and drops the report otherwise, where the sub-configuration is the activated/triggered one(s) for AP/SP-CSI reporting, or the configured ones for P-CSI reporting. |

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| **Company** | **Comments** |
| **Samsung** | 1. The determination of *nCSI\_ref*   We are open to discuss this point but the proposed wording change is questionable. In our understanding, *nCSI\_ref* is checked per triggered sub-configuration and the maximum value among them is used as *nCSI\_ref* for the corresponding CSI reporting. Also, the case of periodic CSI-RS report should be added as well.  Hence, we propose the following:   * The CSI-RS resources above are counted based on the number of CSI-RS resources for channel measurement for a sub-configuration**,** where the sub-configuration is with the maximum number of CSI-RS resources for channel measurement among all the triggered sub-configurations for a semi-persistent CSI report or among all the configured sub-configurations for a periodic CSI report.  1. For C-DRX related change, fine with the CR. 2. For Cell DTX related change, the condition of “For a CSI report configuration containing a list of sub-configurations provided by *csi-ReportSubConfigList* on a serving cell with cell DTX activated [10, TS 38.321]” is incorrect since the serving cell for CSI measurement may not be the same serving cell for CSI-*ReportConfig*. Suggest to defer the discussion of this part until there is more progress on the discussion of cell DTX. |
| **LG Electronics** | 1. For the definition of CSI reference resource   Previously we had an extensive discussion for this issue and the conclusion was to keep the legacy principle, which means CSI reference resource rule is determined based on how many CSI-RS resources are associated with the CSI report configuration, regardless of how many sub-configurations are activated/triggered for SP-CSI reporting. To be specific, for Type 1 SD or PD adaptation case, since all CSI-RS resources are linked to every sub-configuration, triggering/activating parts of configured sub-configurations has no impact on defining CSI reference resource. On the other hand, for Type 2 SD adaptation case, Google’s TP takes an effect only if a single sub-configuration is triggered/activated when the sub-configuration is configured with a list containing a single CSI-RS resource, which seems to be a corner case. With this regard, we don’t think the TP from Google is necessary.   1. For UE C-DRX related changes,    1. The first paragraph is OK    2. For the second paragraph, considering that the case happens only for P-CSI reporting (as highlighted below), we don’t need to say anything for SP/AP-CSI reporting so suggest the following modifications with green texts.   When DRX is configured, the UE reports a CSI report only if receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement in DRX Active Time no later than CSI reference resource and drops the report otherwise. When DRX is configured, for a CSI report configuration containing a list of sub-configurations provided by *csi-ReportSubConfigList*, UE reports a CSI report including one or more sub-reports only if receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement in DRX Active Time, per sub-configuration, no later than CSI reference resource and drops the report otherwise, where the sub-configuration is the activated/triggered one(s) for AP/SP-CSI reporting, or the configured ones for P-CSI reporting. When the UE is configured to monitor DCI format 2\_6 and if the UE configured by higher layer parameter *ps-TransmitOtherPeriodicCSI* to report CSI with the higher layer parameter *reportConfigType* set to 'periodic' and *reportQuantity* set to quantities other than 'cri-RSRP', 'ssb-Index-RSRP', 'cri-RSRP- Index', and 'ssb-Index-RSRP- Index ' when *drx-onDurationTimer* is not started, the UE shall report CSI during the time duration indicated by *drx-onDurationTimer* in *DRX-Config* also outside active time according to the procedure described in Clause 5.2.1.4 if receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement during the time duration indicated by drx-onDurationTimer in *DRX-Config* outside DRX active time or in DRX Active Time no later than CSI reference resource and drops the report otherwise. For a CSI report configuration containing a list of sub-configurations provided by *csi-ReportSubConfigList*, when the UE is configured to monitor DCI format 2\_6 and if the UE configured by higher layer parameter *ps-TransmitOtherPeriodicCSI* to report CSI with the higher layer parameter *reportConfigType* set to 'periodic' and *reportQuantity* set to quantities other than 'cri-RSRP', 'ssb-Index-RSRP', 'cri-RSRP- Index', and 'ssb-Index-RSRP- Index' when *drx-onDurationTimer* is not started, UE shall report a CSI report including one or more sub-reports only during the time duration indicated by *drx-onDurationTimer* in *DRX-Config* also outside active time according to the procedure described in Clause 5.2.1.4 if receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement during the time duration indicated by drx-onDurationTimer in *DRX-Config* outside DRX active time or in DRX Active Time, per sub-configuration, no later than CSI reference resource and drops the report otherwise, where the sub-configuration is ~~the activated/triggered one(s) for AP/SP-CSI reporting, or~~ the configured ones for P-CSI reporting. When the UE is configured to monitor DCI format 2\_6 and if the UE configured by higher layer parameter *ps-TransmitPeriodicL1-RSRP* to report L1-RSRP with the higher layer parameter *reportConfigType* set to 'periodic' and *reportQuantity* set to 'cri-RSRP', 'ssb-Index-RSRP', 'cri-RSRP- Index', or 'ssb-Index-RSRP- Index' when *drx-onDurationTimer* is not started, the UE shall report L1-RSRP during the time duration indicated by *drx-onDurationTimer* in *DRX-Config* also outside active time according to the procedure described in clause 5.2.1.4 and when reportQuantity set to 'cri-RSRP' or *'*cri-RSRP- *Index*' if receiving at least one CSI-RS transmission occasion for channel measurement during the time duration indicated by drx-onDurationTimer in *DRX-Config* outside DRX active time or in DRX Active Time no later than CSI reference resource and drops the report otherwise.   1. For cell DTX related change,   We are fine with it. |
| **ZTE, Sanechips** | (1)The determination of *nCSI\_ref*  Agree with LG, we had a conclusion as following in RAN1#114bis meeting, and the TP is not needed.   |  | | --- | | **Conclusion - RAN1#114bis**  There is no consensus on the following proposal:  For a P/SP-CSI report configuration containing a list of *L* sub-configurations, if at least one subConfig (which is the triggered one for SP-CSI reporting, or configured one for P-CSI report) is associated with more than one CSI-RS resource, nCSI\_ref is the smallest value >=5\*2μDL; otherwise, it is the smallest value no smaller than 4\*2μDL |   (2)For DCI format 2-6 related change,  OK with LG’s changes. Moreover, it is noted that the condition of DCI format 2-6 scenario is “*reportQuantity* set to quantities other than 'cri-RSRP', 'ssb-Index-RSRP', 'cri-RSRP- Index', and 'ssb-Index-RSRP- Index '”, which is also the same with the condition that CSI report can be configured with sub-configurations. Thus, the following change with yellow highlighted is suggested.  When the UE is configured to monitor DCI format 2\_6 and if the UE configured by higher layer parameter *ps-TransmitOtherPeriodicCSI* to report CSI with the higher layer parameter *reportConfigType* set to 'periodic' and *reportQuantity* set to quantities other than 'cri-RSRP', 'ssb-Index-RSRP', 'cri-RSRP- Index', and 'ssb-Index-RSRP- Index ' when *drx-onDurationTimer* is not started, the UE shall report CSI during the time duration indicated by *drx-onDurationTimer* in *DRX-Config* also outside active time according to the procedure described in Clause 5.2.1.4 if receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement during the time duration indicated by drx-onDurationTimer in *DRX-Config* outside DRX active time or in DRX Active Time no later than CSI reference resource and drops the report otherwise. For a CSI report configuration containing a list of sub-configurations provided by *csi-ReportSubConfigList*, when the UE is configured to monitor DCI format 2\_6 and if the UE configured by higher layer parameter *ps-TransmitOtherPeriodicCSI* to report CSI with the higher layer parameter *reportConfigType* set to 'periodic' ~~and~~ *~~reportQuantity~~* ~~set to quantities other than 'cri-RSRP', 'ssb-Index-RSRP', 'cri-RSRP- Index', and 'ssb-Index-RSRP- Index'~~ when *drx-onDurationTimer* is not started, UE shall report a CSI report including one or more sub-reports only during the time duration indicated by *drx-onDurationTimer* in *DRX-Config* also outside active time according to the procedure described in Clause 5.2.1.4 if receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement during the time duration indicated by drx-onDurationTimer in *DRX-Config* outside DRX active time or in DRX Active Time, per sub-configuration, no later than CSI reference resource and drops the report otherwise, where the sub-configuration is ~~the activated/triggered one(s) for AP/SP-CSI reporting, or~~ the configured ones for P-CSI reporting.  (3)For cell DTX related change,  OK with the proposed TP. |
| **Fujitsu** | For the determination of *nCSI\_ref* for periodic/semi-persistent CSI reporting, we share the same view as LGE and ZTE that the TP is not needed.  For the C-DRX related CR, we support ZTE’s proposed version.  For the cell DRX related CR, we are fine with it. |
| **CATT** | We don’t see any necessary correction from the all text proposals. |
| **Apple** | 1. Agree with LGE and ZTE, for the definition of CSI reference resource, we had the discussion for SP-CSI report in RAN1 #114bis, but no consensus was reached. Our understanding is that no change to the current spec will be made.  |  | | --- | | **RAN1 #114bis Conclusion**  There is no consensus on the following proposal:  For a P/SP-CSI report configuration containing a list of *L* sub-configurations, if at least one subConfig (which is the triggered one for SP-CSI reporting, or configured one for P-CSI report) is associated with more than one CSI-RS resource, nCSI\_ref is the smallest value >=5\*2μDL; otherwise, it is the smallest value no smaller than 4\*2μDL |  1. For the C-DRX related TP, we support LGE’s version 2. For the cell DRX related CR, we are generally fine. |
| **Huawei, HiSilicon** | OK with the TP in general.  For the second issue, ok with LGe and apple’s view, which is capatured in the proposed TP above. |
| **Google** | OK with all the TPs. Also OK with Samsung’s change for the first TP.  Just clarification for the first TP, it is different from the proposal in the conclusion, but it is how to count the number of CSI-RS resources for SP report case in current spec – whether it should be counted based on triggered sub-configuration or all configured sub-configuration. |
| **vivo** | * + - 1. For the definition of CSI reference resource, agree that it has been discussed and the conclusion is not to update current spec;       2. For UE C-DRX related TP, we support LGE’s version       3. For cell DTX related TP, we are fine with the proposed TP. |

1. **RRC for CSI-ReportSubConfig**

Both Huawei, Google propose to ask RAN2 to capture the following RRC parameters (RI restriction, codebookSubsetRestriction, codebookMode, non-PMI-PortIndication) in *CSI-ReportSubConfig*, as they are supposed to be included as agreed in RAN1 but not properly captured in the LS of RRC parameters sent to RAN2.

**###### Proposal**

**Send LS to RAN2 for updating the description for the following RRC parameters.**

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| Netw\_Energy\_NR-Core | SD and PD adaptation |  |  | CSI-ReportConfig |  | csi-ReportSubConfig | New |  | Configure parameters in one sub-configuration within a CSI report configuration.  The parameters include 0) Sub-configuration ID (csi- ReportSubConfigID) 1) Either 1a) or 1b) or neither as follows  1a)  ~~- codebook subset restriction,  - rank restriction - N1, N2 if single panel codebook is configured and additionally Ng if multi-panel codebook configured -~~ *~~twoTX-CodebookSubsetRestriction,~~*  - codebookType in CodebookConfig, only Type1 is supported - CSI-RS antenna port subset indication by bitmap (port-subsetIndicator);  - non-PMI-PortIndication  1b)  - a list of *nzp-CSI-RS-resources* corresponding to the assocaited resources in the CSI resource set (nzp- CSI-RS-resourceList) ;  2) a power offset value (powerOffset)  Note 1: No simultaneous configuration of 1a) and 1b) in a same CSI report configuration. Note 2: only codebook Type 1 is allowed. Note 3: A sub-configuration always contains at least one of 1) and 2).  Note 4:  - When only 1b) is configured in a CSI-ReportConfig, a list of NZP CSI-RS resources in a sub- configuration has no intersection with the list of NZP CSI-RS resources configured for any other sub-configuration(s) within the CSI-ReportConfig. - When only 1b) or both of 1b) and 2) are configured in a CSI-ReportConfig, the non-PMI-PortIndication, or typeISinglePanel-codebookSubsetRestriction-i2 is configured in CSI-ReportConfig instead of in sub-configuration. - When only 1a) or both 1a) and 2) are configured in a CSI-ReportConfig,   o For reportQuantity set to 'cri-RI-i1-CQI', typeISinglePanel-codebookSubsetRestriction-i2 is configured in each sub-configuration that includes port-subsetIndicator  o For reportQuantity set to 'cri-RI-CQI', non-PMI-PortIndication, if configured, to be configured in each sub-configuration containing port-subsetIndicator. Ports selected in the non-PMI-PortIndication correspond to enabled ports in the bitmap port-subsetIndicator   If non-PMI-PortIndication is not configured in a sub-configuration, UE applies legacy behavior as described in [TS 38.214, XXX] after re-indexing CSI-RS port indices, by replacing P with the number of enabled ports in the bitmap port-subsetIndicator configured for the sub-configuration.  o If at least one sub-configuration corresponding to 'typeI-SinglePanel' and at least one sub-configuration corresponding to 'typeI-MultiPanel', codebookMode is configured in each sub-configuration that includes port-subsetIndicator  ~~FFS: Note 4: For 1a), the values configured for codebook subset restriction, rank restriction, N1,N2,Ng, and twoTX-CodebookSubsetRestriction shall be consistent with the total number of enabled CSI-RS antenna ports in the bitmap portsubsetIndicator for that sub-configuration. These values override the corresponding ones in codebookConfig configured within the CSIReportConfig.~~ |

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| **Company** | **Comments** |
| **Samsung** | Support the proposal. |
| **LG Electronics** | We are OK in principle, but this issue can be brought up by RAN2 on their own without creating an LS. |
| **ZTE, Sanechips** | OK |
| **Fujitsu** | support |
| **CATT** | We are OK with the clarification. However, it is up to RAN2 to change the schematic description. |
| **Apple** | Agree in general, but similar comment as LGE as RAN2 is already raising this issue, seems no LS is needed. |
| **Xiaomi** | Support |
| **Huawei, HiSilicon** | Support |
| **Google** | Support. We can also provide a detailed table for each parameter to RAN2. Actually we provided some information before, but RAN2 did not notice that. |
| **vivo** | We are OK with the proposal, but it can also be handled in RAN2 |

1. **Port number determination for non-PMI feedback**

Huawei propose to clarify the possible number of ports that can be enabled for non-PMI feedback, which is same with the legacy specification allowed values.

**###### Proposal**

**Adopt the following TP for clause 5.2.1.4.2 of TS 38.214.**

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| --- |
| **TP#4**  **Reason for change:**  For non-PMI feedback in type-1 SD, the value of P is not defined.  **Summary of change:**  For non-PMI feedback in type-1 SD, the value of P is same as the legacy, i.e. {1, 2, 4, 8}.  **Consequence if not approved:**  The value of P in non-PMI feedback in type-1 SD is not clear.  ---------------------------- Start of Text Proposal for TS 38.214 -----------------------------  < Unchanged parts are omitted >  5.2.1.4.2 Report quantity configurations  < Unchanged parts are omitted >  If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-RI-CQI',  - if the UE is configured with higher layer parameter *non-PMI-PortIndication* contained in a *CSI-ReportConfig,* *r* ports are indicated in the order of layer ordering for rank *r* and each CSI-RS resource in the CSI resource setting is linked to the *CSI-ReportConfig* based on the order of the associated *NZP-CSI-RS-ResourceId* in the linked CSI resource setting for channel measurement given by higher layer parameter *resourcesForChannelMeasurement*. The configured higher layer parameter *non-PMI-PortIndication* contains a sequence  of port indices, where  are the CSI-RS port indices associated with rank ν and  where is the number of ports in the CSI-RS resource. The UE shall only report RI corresponding to the configured fields of *PortIndexFor8Ranks*. If the UE is configured with a *CSI-ReportConfig* that contains a list of sub-configurations with [*port-subsetIndicator*] configured in each sub-configuration, and the higher layer parameter *non-PMI-PortIndication* is separately provided for a sub-configuration, then *~~P~~* corresponds to the number of bits with value 1 in the bitmap [*port-subsetIndicator*] for the sub-configuration and the CSI-RS port indices are derived by mapping antenna ports corresponding to all bits with value of 1 in [*port-subsetIndicator*] as consecutive antenna ports starting at CSI-RS port index 0 in increasing order of the bit position in [*port-subsetIndicator*].  - if the UE is not configured with higher layer parameter *non-PMI-PortIndication,* the UE assumes, for each CSI-RS resource in the CSI resource setting linked to the *CSI-ReportConfig*, that the CSI-RS port indices  are associated with ranks  where  is the number of ports in the CSI-RS resource. If the UE is configured with a *CSI-ReportConfig* that contains a list of sub-configurations with [*port-subsetIndicator*] configured in each sub-configuration and the higher layer parameter *non-PMI-PortIndication* is not provided for a sub-configuration, then *~~P~~* corresponds to the number of bits with value 1 in the bitmap [*port-subsetIndicator*] for the sub-configuration and the CSI-RS port indices are derived by mapping antenna ports corresponding to all bits with value of 1 in [*port-subsetIndicator*] as consecutive antenna ports starting at CSI-RS port index 0 in increasing order of the bit position in [*port-subsetIndicator*].  - When calculating the CQI for a rank, the UE shall use the ports indicated for that rank for the selected CSI-RS resource. The precoder for the indicated ports shall be assumed to be the identity matrix scaled by .  < Unchanged parts are omitted >  --------------------------------------- End of Text Proposal ---------------------------------- |

|  |  |
| --- | --- |
| **Company** | **Comments** |
| **Samsung** | Support the proposal. |
| **LG Electronics** | Support the proposal. |
| **Spreadtrum** | OK |
| **ZTE, Sanechips** | Support the proposal. |
| **Fujitsu** | We are fine with the proposal. |
| **CATT** | This is the Rel-15 text and not an essential correction. |
| **Apple** | Support. |
| **Xiaomi** | Support |
| **Huawei, HiSilicon** | OK |
| **Google** | OK |
| **vivo** | Support |

1. **UE procedure for reporting multi-UCI types**

In legacy, when UE reports multiple UCI typs, if multiple CSI reports are multiplexed on PUSCH, there is a condition for CSI report update concerning the PUCCH/PUSCH timeline based on the last symbol of aperiodic CSI-RS resource for channel measurements, aperiodic CSI-IM used for interference measurements and aperiodic NZP CSI-RS for interference measurements for the triggered CSI report.

Vivo consider that in the case of CSI sub-reports configured and triggered within a CSI report *n*, which could correspond to part of the configured sub-configurations in its CSI report config, there is a need to clarify the concerned ‘last symbol’ w.r.t. the resources and corresponding sub-configurations, i.e. the CMR and IMR and NZP based IMR are the resources included in all triggered sub-configurations. The proposed TP seems also in line with what is implemented in TS 38.214 for CSI computation time.

The following TP can be considered based on vivo’s version, with update on coversheet and correction to typo in spec.

**###### Proposal**

**Adopt the following TP for TS 38.213.**

|  |
| --- |
| **TP#5 for TS 38.213**   * Reason for changes   + Only CMR and IMR and NZP based IMR corresponding to the triggered sub-configurations should be considered for the timeline for reporting multiple UCI types if CSI-ReportConfig contains multiple sub-configurations. * Summary of changes   + Clarify that only CMR and IMR and NZP based IMR corresponding to triggered sub-configurations should be considered for the timeline for reporting multiple UCI types if CSI-ReportConfig contains multiple sub-configurations. * Consequences if not approved   + Unclear UE behaviors about UE procedure for reporting multiple UCI types if CSI-ReportConfig contains multiple sub-configurations.   9.2.5 UE procedure for reporting multiple UCI types  *\*\*\* Unchanged text is omitted \*\*\**  If there is one or more aperiodic CSI reports multiplexed on a PUSCH in the group of overlapping PUCCHs and PUSCHs and if symbol is before symbol that is a next uplink symbol with CP starting after after the end of the last symbol of  - the last symbol of aperiodic CSI-RS resource for channel measurements, and  - the last symbol of aperiodic CSI-IM used for interference measurements, and  - the last symbol of aperiodic NZP CSI-RS for interference measurements for a *CSI-ReportConfig*, or for all triggered sub-configurations if *CSI-ReportConfig* contains multiple sub-configurations, when aperiodic CSI-RS is used for channel measurement for triggered CSI report  the UE is not required to update the CSI report for the triggered CSI report *.* is defined in [6, TS 38.214] and corresponds to the smallest SCS configuration among the SCS configurations of the PDCCHs scheduling the PUSCHs, the smallest SCS configuration of aperiodic CSI-RSs associated with DCI formats provided by the PDCCHs triggering the aperiodic CSI reports, and the smallest SCS configuration of the overlapping PUCCHs and PUSCHs and for , for and for .  *\*\*\* Unchanged text is omitted \*\*\** |

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| --- | --- |
| **Company** | **Comments** |
| **Samsung** | Support the proposal. This change is inline with the description of Z timeline for CSI computation time. |
| **LG Electronics** | Support the proposal. |
| **Fujitsu** | Support |
| **CATT** | This is not an essential correction. |
| **Huawei, HiSilicon** | ok |
| **Google** | Support |
| **vivo** | Support |

1. **Restriction on the number of ports/active resources**

From *RAN1#115:*

*Alt 1: Clarify that the following restriction in TS 38.214 is applied on each sub-configuration for a CSI report containing L sub-configurations:*

*‘If CSI-RS resources are configured, each resource shall contain at most 16 CSI-RS ports. If CSI-RS resources are configured, each resource shall contain at most 8 CSI-RS ports’*

*Alt 2: Extend the current total number of antenna ports to [64] ports for the CSI-RS resources within a resource set, similar to M-TRP. This is subject to a separate UE capability.*

*Alt 3: No consensus to make changes to current RAN1 spec*

For the above issue, CATT propose to agree on Alt 3 since the main use case of the restriction is for FR2 where the current allowed maximum number of antenna ports in case of multi-CSI-RS resources is sufficient, i.e. 8 or 16.

Since this is the only company raising this issue and no TP is needed, if no further discussion is requested, the consequence would be the same. FL assume that there is no further strong willingness to change spec about this restriction anymore, **therefore no further discussion is needed**.

1. **Definition of Ps in active CSI-RS resource/port counting**

ZTE propose to clarify that the ***sub-configuration s*** inbelow texts in Subclause 5.2.1.6 in TS 38.214 should be the *s*-th sub-configuration, which FL consider is the intention of the original text, however may be benefical if can be clarified with modified texts.

*For a CSI-ReportConfig containing a list of L sub-configuration(s) provided by higher layer parameter csi-ReportSubConfigList, if a CSI-RS resource is referred by M sub-configurations among N triggered sub-configurations for CSI reporting for aperiodic CSI-RS resource, or L configured sub-configurations for CSI reporting for periodic or semi-persistent CSI-RS resource, the CSI-RS resource is counted M times and the CSI-RS ports within the CSI-RS resource are counted , where P is the number of ports configured by nrofPorts and*  ***is the number of CSI-RS ports in sub-configuration s*** *derived from the corresponding antenna port subset indicator [port-subsetIndicator] according to clause 5.2.1.4.2 if configured, otherwise .*

**###### Proposal**

**Adopt the following TP for Subclause 5.2.1.6 in TS 38.214.**

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| --- |
| **TP#7**  Reason for changes:   * The definition of Ps is incorrect for AP-CSI. |
| Summary of changes:   * Clarify the definition of Ps. |
| Consequences if not approved   * The counting of active CSI-RS resources/ports for NES is incorrect for AP-CSI. |
| 5.2.1.6 CSI processing criteria <omitted text>  For a *CSI-ReportConfig* containing a list of *L* sub-configuration(s) provided by higher layer parameter *csi-ReportSubConfigList,* if a CSI-RS resource is referred by *M* sub-configurations among *N* triggered sub-configurations for CSI reporting for aperiodic CSI-RS resource, or *L* configured sub-configurations for CSI reporting for periodic or semi-persistent CSI-RS resource, the CSI-RS resource is counted *M* times and the CSI-RS ports within the CSI-RS resource are counted , where *P* is the number of ports configured by *nrofPorts* and is the number of CSI-RS ports in *s*-th sub-configuration *~~s~~* from *M* sub-configurations derived from the corresponding antenna port subset indicator [*port-subsetIndicator*] according to clause 5.2.1.4.2 if configured, otherwise .  <omitted text> |

|  |  |
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| **Company** | **Comments** |
| **Samsung** | Not essential. This existing spec already well describes the calculation of active ports for sub-configurations. |
| **LG Electronics** | Support the proposal. |
| **Spreadtrum** | Not necessary |
| **ZTE, Sanechips** | We think the original description of of ‘sub-configuration s’ can be misunderstood as sub-configuration with index s, regardless whether the sub-configuration s is activated or not. Thus , we think the TP is needed. |
| **Fujitsu** | Fine but we think that the original text and modified one have the same meaning. |
| **CATT** | This is not an essential correction |
| **Apple** | Fine with proposal to make the spec more clear. |
| **Xiaomi** | Similar virw with Samsung. It is not an essential modification. |
| **Huawei, HiSilicon** | The original spec is ok. But we are also fine with the TP . |
| **Google** | OK |
| **vivo** | Not essential correction but fine with the TP. |

1. **Bitwidth determination for PMI/RI/LI/CQI field**

For determing the the bitwidth of a PMI/RI/LI/CQI field, the CSI-RS ports are calculated based on configured number of ports according to the current specification, e.g. Table 6.3.1.1.2-1 in TS 38.212. For a sub-configuration configured with *port-SubsetIndicator*, the number of ports used for determing the bitwidth of those field should refer to the enabled number of ports by *port-SubsetIndicator*. A TP is provided by Samsung for clarifying this, and used as base with minor update for further consideration of adoption.

**###### Proposal**

**Adopt the following TP for TS 38.212.**

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| --- |
| **TP#8**  **Reason for change:** The UE behavior is unclear for the determination of a PMI/RI/LI/CQI bitwidth for a sub-configuration when the sub-configuration is configured with *port-SubsetIndicator*.  **Summary of change:** Clarify the UE behavior for the determination of a PMI/RI/LI/CQI bitwidth for a sub-configuration when the sub-configuration is configured with *port-SubsetIndicator*.  **Consequences if not approved:**Undefined UE behavior for the determination of a PMI/RI/LI/CQI bitwidth for a sub-configuration when the sub-configuration is configured with *port-SubsetIndicator*.  --------------------start of TP--------------------------  **6.3.1.1.2 CSI only**  <omitted texts>  If *cqi-BitsPerSubband* is configured, this Clause 6.3.1.1.2 applies by taking Subband CQI as Subband differential CQI and replacing the corresponding number of bits 2 by 4.  If *csi-ReportSubConfig* is configured, for a corresponding CSI sub-report, the bitwidth of a CSI field of the CSI sub-report is determined following the procedure in this clause 6.3.1.1.2 by taking configurations in *CSI-ReportSubConfig* when applicable. If *csi-ReportSubConfig* configures a list of CSI-RS resource IDs, for the determination of the bitwidth of a CRI field, the value of is the number of CSI-RS resources configured in the corresponding *csi-ReportSubConfig*. If *csi-ReportSubConfig* configures *port-SubsetIndicator*, for the determination of the bitwidth of a PMI/RI/LI/CQI field, the number of CSI ports or antenna ports is the number of bits with value of 1 in *port-SubsetIndicator* in the corresponding *csi-ReportSubConfig*.  <omitted texts>  **6.3.2.1.2 CSI**  <omitted texts>  If *cqi-BitsPerSubband* is configured, this Clause 6.3.2.1.2 applies by taking Subband CQI as Subband differential CQI and replacing the corresponding number of bits 2 by 4.  If *csi-ReportSubConfig* is configured, for a corresponding CSI sub-report, the bitwidth of a CSI field of the CSI sub-report is determined following the procedure in this clause 6.3.2.1.2 by taking configurations in *CSI-ReportSubConfig* when applicable. If *csi-ReportSubConfig* configures a list of CSI-RS resource IDs, for the determination of the bitwidth of a CRI field, the value of is the number of CSI-RS resources configured in the corresponding *csi-ReportSubConfig*. If *csi-ReportSubConfig* configures *port-SubsetIndicator*, for the determination of the bitwidth of a PMI/RI/LI/CQI field, the number of CSI ports or antenna ports is the number of bits with value of 1 in *port-SubsetIndicator* in the corresponding *csi-ReportSubConfig*.  <omitted texts>  --------------------end of TP-------------------------- |

|  |  |
| --- | --- |
| **Company** | **Comments** |
| **Samsung** | Support the proposal. This is similar to the clarification of Ks in case of a subset of CSI-RS resources are selected from CMR set. |
| **LG Electronics** | Support the proposal. |
| **ZTE, Sanechips** | The bitwidth determination is clear based on the following text in TS38.213.  ‘If *csi-ReportSubConfig* is configured, for a corresponding CSI sub-report, the bitwidth of a CSI field of the CSI sub-report is determined following the procedure in this clause 6.3.1.1.2 by taking configurations in *CSI-ReportSubConfig* when applicable.’ |
| **Fujits** | According to the Table 6.3.1.1.2-1 in TS 38.212, the bitwidth of PMI/RI/LI/CQI field is determined by N1, N2. Since N1 and N2 are configured per-subconfiguration for the case that *csi-ReportSubConfig* configures *port-SubsetIndicator*, the determination of the bitwidth is clear and the proposed TP is not needed. |
| **CATT** | This is not an essential correction |
| **Apple** | Support the proposal. From ZTE’s quotation, although the determination of bitwidth of a CSI field is mentioned in TS38.213, it was a general description. We think it would be better to add the details here. |
| **Huawei, HiSilicon** | Not needed clarification. But it is ok for us. |
| **Google** | Agree with ZTE |

1. **CPU occupation for SP-CSI report on PUCCH**

Apple proposed the following.

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| --- |
| **Reason for change:** For CPU occupation for SP-CSI report, the current spec only mentioned the triggered sub-configuration, missing the activated sub-configuration. |
| **Summary of change:**  Added “activated” to cover the case of SP-CSI on PUCH |
| **Consequences if not approved:** The CPU occupation for SP-CSI activated on PUCCH is not covered by spec |
| -----------------------------------------------------------Text proposal -----------------------------------------------------------  5.2.1.6 CSI processing criteria  <Unchanged parts omitted>  For a CSI report with *CSI-ReportConfig* with higher layer parameter *reportQuantity* not set to 'none', the CPU(s) are occupied for a number of OFDM symbols as follows:  - A periodic or semi-persistent CSI report (excluding an initial semi-persistent CSI report on PUSCH after the PDCCH triggering the report) occupies CPU(s) from the first symbol of the earliest one of each CSI-RS/CSI-IM/SSB resource, or each CSI-RS/CSI-IM resource associated with all configured sub-configurations for periodic CSI report corresponding to a *CSI-ReportConfig* that contains a list of sub-configurations provided by *csi-ReportSubConfigList*, or each CSI-RS/CSI-IM resource associated with all activated/triggered sub-configurations for semi-persistent CSI report corresponding to a *CSI-ReportConfig* that contains a list of sub-configurations provided by *csi-ReportSubConfigList*, for channel or interference measurement, respective latest CSI-RS/CSI-IM/SSB occasion no later than the corresponding CSI reference resource, until the last symbol of the configured PUSCH/PUCCH carrying the report.  <Unchanged parts omitted>  -------------------------------------------------------End of Text proposal ------------------------------------------------------ |

**###### Proposal**

**Adopt the above TP#9 for TS38.214.**

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| --- | --- |
| **Company** | **Comments** |
| **Samsung** | Support the proposal. |
| **LG Electronics** | Support the proposal. |
| **ZTE, Sanechips** | OK |
| **Fujitsu** | Support |
| **CATT** | OK |
| **Apple** | Support. |
| **Xiaomi** | OK |
| **Huawei, HiSilicon** | ok |
| **Google** | OK |
| **vivo** | OK |

1. **NZP CSI-RS resource list configuration restriction for SD+PD joint adaptataion**

LGe consider that clarification is needed for the operation of joint adaptataion, for the configured NZP CSI-RS resource list. That is, the sub-configurations with different power offset delta values can share the resource list as shown in Figure below (sub-configurations #1 and #2, or sub-configurations #3 and #4), while those that do not have the common list (sub-configurations #1 and #3) should be configured with disjoint resource lists.

This was discussed in RAN1#115 while the view from the other side is to leave it to gNB configuration for flexibility.



**###### Proposal**

**Determine whether the following restriction is needed, and if so, consider to adopt the TP for TS38.214**

* For type 2 SD + PD adaptation, the NZP CSI-RS resource list configured for a sub-configuration is identical to or has no intersection with the resource list configured for another sub-configuration within the same CSI report configuration.

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| **TP#10**  **Reason for Change:**   * The restriction on configuring a list of NZP CSI-RS resource IDs for type 2 SD + PD adaptation is not specified.   **Summary of Change:**   * For type 2 SD + PD adaptation, the NZP CSI-RS resource list configured for a sub-configuration is identical to or has no intersection with the resource list configured for another sub-configuration within the same CSI report configuration.   **Consequences if not approved:**   * Arbitrary configuration for a list of NZP CSI-RS resource IDs for type 2 SD + PD adaptation is allowed.   5.2.1.4.2 Report quantity configurations  <Unchanged texts omitted>  If the UE is configured with a *CSI-ReportConfig* that contains a list of sub-configurations, provided by [*csi-ReportSubConfigList]*:  - The UE expects to be configured with the higher layer parameter *codebookType* set to 'typeI-SinglePanel' or 'typeI-MultiPanel'. If the UE indicates a capability for supporting mixed codebook combination in a slot with [ABC], each sub-configuration can be configured with the higher layer parameter *codebookType* set to 'typeI-SinglePanel' or 'typeI-MultiPanel'.  - Each sub-configuration can be configured with an antenna port subset using the higher layer bitmap parameter [*port-subsetIndicator*] which contains the bit sequence , where is the MSB and is the LSB, bit corresponds to antenna port , and is the number of ports *nrofPorts* configured for the CSI-RS resources(s) within a *NZP-CSI-RS-ResourceSet* contained in the *CSI-ResourceConfig* for channel measurement that corresponds to the *CSI-ReportConfig*. A bit value 0 in [*port-subsetIndicator*] indicates that the corresponding antenna port is disabled for the sub-configuration, whereas bit value 1 indicates that the antenna port is enabled and belongs to the antenna port subset for the sub-configuration. For the derivation of PMI, antenna ports corresponding to all bits with value of 1 in [*port-subsetIndicator*] are mapped to consecutive antenna ports starting at CSI-RS antenna port 3000 in increasing order of the bit position in [*port-subsetIndicator*].  - If a sub-configuration is configured with an antenna port subset, then the sub-configuration can be configured with a [RI restriction parameter] and, if the number of antenna ports of the subset greater than 2, with [*n1-n2* parameter] if the higher layer parameter *codebookType* is set to 'typeI-SinglePanel' or with [*ng*-*n1-n2* parameter] if the higher layer parameter *codebookType* is set to 'typeI-MultiPanel', and, if the corresponding number of antenna ports of the subset is 2, with *twoTX-CodebookSubsetRestriction*, where the parameters [RI restriction], [*n1-n2],* [*ng*-*n1-n2],* *twoTX-CodebookSubsetRestriction* are as described in Clauses 5.2.2.2.1 and 5.2.2.2.2. If a sub-configuration is configured with an antenna port subset, and if higher layer parameter *reportQuantity* is set to 'cri-RI-i1-CQI', and if the higher layer parameter *codebookType* is set to 'typeI-SinglePanel', then the sub-configuration can be configured with higher layer parameter *typeI*-*SinglePanel-codebookSubsetRestriction-i2*, where *typeI*-*SinglePanel-codebookSubsetRestriction-i2* is as described in Clause 5.2.2.2.1.  - If a sub-configuration is configured with an antenna port subset, and if the *CSI-ReportConfig* that contains a mix of sub-configuration(s) each corresponding to 'typeI-SinglePanel' some other sub-configuration(s) each corresponding to 'typeI-MultiPanel', then the sub-configuration(s) can be configured with the higher layer parameter *codebookMode.*  - A sub-configuration can be configured with a power offset provided by [*powerOffse*t].  - A sub-configuration can be configured with a list of NZP CSI-RS resources, provided by [*nzp-CSI-RS-resourceList*], which indicates one or more NZP CSI-RS resources, within a *NZP-CSI-RS-ResourceSet* contained in the *CSI-ResourceConfig* for channel measurement which corresponds to the *CSI-ReportConfig.* If there is no sub-configuration configured with a power offset provided by *[powerOffset],* the list of NZP CSI-RS resources has no intersection with a list of NZP CSI-RS resources configured for any other sub-configuration(s) within the *CSI-ReportConfig*, otherwise, the list of NZP CSI-RS resources is identical to or has no intersection with a list of NZP CSI-RS resources configured for any other sub-configuration(s) within the *CSI-ReportConfig*.  - If a sub-configuration is configured with a list of NZP CSI-RS resources with more than one resource, the UE shall derive the CSI parameters other than CRI conditioned on the reported CRI, where the CRI *k* (*k* ≥ 0) for the sub-configuration corresponds to the configured (*k*+1)-th entry of associated *NZP-CSI-RS-Resource* in the list of NZP CSI-RS resources.  - If a sub-configurations is not configured with [*nzp-CSI-RS-resourceList*] then the sub-configuration shall be associated with all the NZP CSI-RS resources within a *NZP-CSI-RS-ResourceSet* contained in the *CSI-ResourceConfig* for channel measurement which corresponds to the *CSI-ReportConfig.*  - the UE reports CSI(s) for one or more sub-configurations according to Clauses 5.2.1.5.1, 5.2.1.5.2, 5.2.3 and 5.2.4, and according to the higher layer parameter *reportQuantity* configured for that *CSI-ReportConfig*.  - The UE does not expect the higher layer parameter *reportQuantity* to be set to 'cri-RSRP', 'cri-SINR', 'cri-SINR- Index', 'cri-RSRP-Index', 'none', 'ssb-Index-RSRP', 'ssb-Index-SINR', 'ssb-Index-RSRP- Index', 'ssb-Index-SINR- Index', or 'tdcp'. |

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| --- | --- |
| **Company** | **Comments** |
| **Samsung** | Support.  From our perspective, LGE’s proposal addresses a valid point. To support joint operation of Type 2 SD and PD adaptation, the list of NZP CSI-RS resource can be identical to a list of NZP CSI-RS resource associated the other sub-configuration with different power offset for PD adaptation. |
| **LG Electronics** | Support the proposal as the proponent. As Samsung stated, if we have a restriction on the list of CSI-RS resources for Type 2 SD, but not for Type 2 SD + PD, the specification could give an impression that arbitrary configuration of the list of CSI-RS resources is allowed for Type 2 SD + PD. |
| **Spreadtrum** | Seems OK |
| **ZTE, Sanechips** | Based on the discussion in the last meeting, our understanding is to let gNB handle this issue properly. |
| **Fujitsu** | We share the same understanding with ZTE that since no consensus was reached on the resource configuration restriction for joint adaptation of Type 2 SD and PD during the last meeting, this matter is left for gNB implementation. |
| **CATT** | Not an essential correction |
| **Huawei, HiSilicon** | We do not feel it is critical issue to agree on. It has been discussed before and it was decided as not needed. |
| **Google** | Agree with ZTE |
|  |  |

1. **Corrections on SSB-less operation**

For R18 NES, one objective is to specify the SSB-less operation for inter-band CA. From RAN1 perspective, the relevant texts (coped below) in TS 38.213 is only relevant to Rel-16 NR-U (see CR0138 to 38.213v16.20 in R1-2007467 and email discussion in [102-e-NR-unlic-NRU-InitAccessProc-01]) thus the reference refers to 38.133 sub-clause 7.1. However, for SSB-less SCell operation context in NES, the relevant text in 38.133 is subclause 8.3, related to SCell Activation and Deactivation Delay.

“For a serving cell without transmission of SS/PBCH blocks, a UE acquires time and frequency synchronization with the serving cell based on receptions of SS/PBCH blocks on the PCell, or on the PSCell, or on an SCell if applicable as described in [10, TS 38.133], of the cell group for the serving cell.”

Therefore, Ericsson propose to clarify the SCell shall be the configured reference serving cell in RAN1 spec, instead of leaving the SCell to be implicitly hidden in the highlighted part above.

Either we can consider to adopt the TP proposed from Ericsson, or we could consider to make a conclusion that the current texts also refer to the case of SCell activation/deactivation.

**###### Proposal**

**Option 1: adopt the following TP for 38.213 sub-clause 4.1**

---------------------------------------------- start TP#11 -----------------------------

4.1 Cell search

<unchanged text omitted>

For a serving cell without transmission of SS/PBCH blocks, a UE acquires time and frequency synchronization with the serving cell based on receptions of SS/PBCH blocks on a reference serving cell if provided by higher layers using *referenceCell*, or on the PCell, or on the PSCell, or on an SCell if applicable as described in [10, TS 38.133], of the cell group for the serving cell.

----------------------------------- end TP#11 ----------------------------------------

**Option 2: proposed Conclusion:**

The “SCell if applicable as described in [10, TS 38.133] ” in the below texts of TS38.213 sub-clause 4.1 can also refer to the reference serving cell provided by higher layer parameter *referenceCell* for Rel-18 NES.

* No spec update is needed.

|  |
| --- |
| ---------------------------------------------- 38.213 v18.1.0 sub-clause 4.1 -----------------------------  4.1 Cell search  <unchanged text omitted>  For a serving cell without transmission of SS/PBCH blocks, a UE acquires time and frequency synchronization with the serving cell based on receptions of SS/PBCH blocks on the PCell, or on the PSCell, or on an SCell if applicable as described in [10, TS 38.133], of the cell group for the serving cell.  <unchanged text omitted> |

|  |  |
| --- | --- |
| **Company** | **Comments** |
| **Samsung** | Prefer Option 2. |
| **LG Electronics** | Prefer Option 2. |
| **ZTE, Sanechips** | Option 2 is preferred.  Our understanding is that “SCell if applicable as described in [10, TS 38.133] ” also includes the case of Rel-18 inter-band SSB-less SCell. |
| **Fujitsu** | We support option 2. |
| **CATT** | We are OK with option 2. |
| **Apple** | Fine with Option 2.  From TS38.133, the relevant definition of the reference serving cell could be the one provided by higher layer parameter *SSB-less-Referencecell*, or the QCL-typeC source cell if UE is not indicated with [*SSB-less-Referencecell*]. Therefore, it would be better if the conclusion includes both of these two options.  The “SCell if applicable as described in [10, TS 38.133] ” in the below texts of TS38.213 sub-clause 4.1 can also refer to the reference serving cell provided by higher layer parameter *~~referenceCell~~**SSB-less-Referencecell*, or the QCL-typeC source cell, if UE is not indicated with [*SSB-less-Referencecell*]for Rel-18 NES   * No spec update is needed.  |  | | --- | | TS38.133 Sec 8.3.2 SCell Activation Delay Requirement for Deactivated SCell  If the SCell being activated belongs to FR1 and if the UE is not provided with SSB configuration (*absoluteFrequencySSB*) in the target SCell (FrequencyInfoDL) nor SMTC configuration for the target SCell, and if there is one collocated active reference serving cell on different FR1 band, when the following conditions are fulfilled for UE supporting [*scellWithoutSSB-interband*],  - The RTD between the target SCell and the colocated reference serving cell is within CP where CP is corresponding to the SCS of SSB-less SCell, and  - The [EPRE] difference at UE side is smaller than or equal to [9] dB, where, [EPRE] difference is the power difference between TRS/A-TRS symbol on the SSB-less SCell and SSB symbol on the reference serving cell [after the compensation for AGC], and  - The RS(s) of the SSB-less SCell being activated is (are) QCL-TypeA with TRS(s) of the SSB-less SCell being activated, and the TRS(s) of the SSB-less SCell being activated is (are) further QCL-TypeC with SSB(s) of an inter-band active serving cell, and the inter-band active serving cell shall be same as the reference serving cell.  where the reference serving cell can be indicated by higherlayer parameter [*SSB-less-Referencecell*]. If UE is not indicated with [*SSB-less-Referencecell*], the reference serving cell is assumed to be the QCL-typeC source cell if there is only one active QCL-typeC source cell configured.  *Editor notes: FFS whether and how to capture if there are more than one QCL source cell.*  *Editor notes: FFS whether and how to capture the wording “*after the compensation for AGC*”.* | |
| **Huawei, HiSilicon** | Prefer Option 2. |
| **Google** | OK with option 2. |
| **vivo** | Prefer Option 2. However, reference cell can be a Pcell, PScell or a Scell. So the conclusion may be revised as:  The “on the PCell, or on the PSCell, or SCell if applicable as described in [10, TS 38.133] ” in the below texts of TS38.213 sub-clause 4.1 can also refer to the reference serving cell provided by higher layer parameter *referenceCell* for Rel-18 NES.  No spec update is needed. |

# Reference

|  |  |  |
| --- | --- | --- |
| **TDoc** | **Title** | **Source** |
| [**R1-2400122**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400122.zip) | Maintenance of Rel-18 NES | Huawei, HiSilicon |
| [**R1-2400183**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400183.zip) | Maintenance on Network Energy Savings for NR | Nokia, Nokia Shanghai Bell |
| [**R1-2400220**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400220.zip) | Maintenance on Rel-18 network energy saving | vivo |
| [**R1-2400372**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400372.zip) | Maintanence issues on NES | Intel Corporation |
| [**R1-2400391**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400391.zip) | Maintenance on NES | Google |
| [**R1-2400410**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400410.zip) | Remaining Issues in Rel-18 Network Energy Saving | CATT |
| [**R1-2400485**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400485.zip) | Remaining issues on Rel-18 NES techniques | ZTE, Sanechips |
| [**R1-2400540**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400540.zip) | Remaining issues on network energy saving | xiaomi |
| [**R1-2400588**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400588.zip) | Discussion on maintenance on network energy saving for NR | OPPO |
| [**R1-2400709**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400709.zip) | Remaining issues on network energy saving | Samsung |
| [**R1-2400900**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400900.zip) | Remaining issues of Rel-18 network energy saving | Panasonic |
| [**R1-2400990**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400990.zip) | Maintenance of Network Energy Savings for NR | Apple |
| [**R1-2401139**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2401139.zip) | Maintenance for Rel-18 network energy savings | Ericsson |
| [**R1-2401185**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2401185.zip) | Correction on cell DTX DRX | ASUSTeK |
| [**R1-2401186**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2401186.zip) | Maintenance of UE procedure for determining physical downlink control channel assignment | ITRI |
| [**R1-2401316**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2401316.zip) | Maintenance on Network Energy Savings for NR | MediaTek Inc. |
| [**R1-2401322**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2401322.zip) | Remaining issues on NES | LG Electronics |
| [**R1-2401419**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2401419.zip) | Maintenance on cell DTX and DRX | Qualcomm Incorporated |

# Appendix

## A. Agreements sorted per technical issue by RAN1#115

**NZP CSI-RS resource configuration for channel measurement**

**Agreement@112**

For the purpose of further discussions in RAN1 on NES spatial domain adaptations, consider the following cases

* Type 1: all antenna elements associated to a logical antenna port is disabled/enabled
* Type 2: part/subset of antenna elements associated to a logical antenna port is disabled/enabled

**Agreement @112bis-e**

Define necessary enhancements to support both types of spatial adaptation cases (as defined in RAN1#112) in Rel-18.

* Note: This does not imply explicit definition in specifications for adaptation types.
* Note: This does not imply explicit specification changes are made for both cases

**Agreement@112**

For spatial element adaptation, further study the following

* A1-1) Each CSI-RS resource/resource set/resource setting can be associated with only one spatial adaptation pattern
  + FFS: Details on how the association is done
* A1-2) Each CSI-RS resource/resource set/resource setting can be associated with one or more spatial adaptation patterns
  + FFS: Details on how the association is done
* FFS: Details on the definition of “spatial adaptation patterns”

**Agreement@112bis-e**

Support configurability of NZP CSI-RS resource(s) for channel measurement within one resource setting corresponding to more than one spatial adaptation patterns with at least one of the following

* A1-1-revised: a resource set with multiple resources is configured within a resource setting, where each resource is associated with only one spatial adaptation pattern
* A1-2-revised: For a resource configured in a resource set within a resource setting, the resource can be associated with more than one spatial adaptation patterns
  + One or more resources can be configured in the resource set for channel measurement.

**Agreement@112bis-e**

* + - For R18 NES, only legacy port configuration values (N1, N2) or (Ng, N1, N2) are supported.
    - FFS: Whether/what restriction for A1-1-revised and A-1-2-revised w.r.t number of ports

**Agreement@113**

* For A1-1-revised for Type 2, one or more CSI-RS resources from a CSI-RS resource set for channel measurement can be associated with the same sub-configuration provided in a CSI report configuration
  + Resources in the resource set for channel measurement have the same number of antenna ports
* For A1-2-revised for Type 1, all CSI-RS resource(s) (which can be one or more) in the CSI-RS resource set for channel measurement are associated with each sub-configuration provided in a CSI report configuration
  + i.e. each CSI-RS resource is associated with all the sub-configurations
  + Resources in the resource set for channel measurement have the same number of antenna ports
* FFS: restriction on total number of CSI-RS resources for channel measurement in a CSI-ReportConfig and/or sub-configuration.

**Working Assumption@112bis-e**

Al-1-revised and A1-2-revised are supported

* + - FFS: Which Type of SD adaptation A1-1-revised and A1-2-revised are applicable for

**Agreement@113**

Confirm the working assumption with the following update (in blue)

* + - Al-1-revised and A1-2-revised are supported
      * For Type 1 SD adaptation
        + A1-2-revised is supported
      * For Type 2 SD adaptation
        + A1-1-revised is supported.

**Conclusion@112bis-e**

New CSI-RS resource (RE mapping) pattern is not introduced for R18 network energy savings purpose.

* Note: CSI-RS resource (RE mapping) pattern above refers to a row in TS 38.211 Table 7.4.1.5.3-1 determining CSI-RS locations within a slot.

**Agreement@114bis**

Only codebook type 1 for PMI is supported for type 2 SD adaptation and PD adaptation.

**CSI report configuration including the sub-configurations**

**Agreement@112**

For spatial element adaptation, further study the following

* A2-1) Independent/separate CSI report configurations where each CSI report configuration corresponds to one spatial adaptation pattern
* A2-2) One CSI report configuration contains multiple CSI report sub-configurations where each sub-configuration corresponds to one spatial adaptation pattern
  + FFS: Details of sub-configuration

**Agreement@112**

For spatial domain adaptation, further study necessary enhancements for multiple CSI(s) where each CSI corresponds to a spatial adaptation pattern, e.g.

* FFS: gNB indicates to UE which CSI(s) the UE shall report
* FFS: the UE selects which CSI(s) are reported
* FFS: multiple CSI(s) are reported in a joint CSI report
* FFS: Overhead reduction for multiple CSI(s)

Note: UE complexity needs to be taken into account.

**Agreement@112bis-e**

At least support A2-2, i.e. one CSI report configuration contains multiple CSI report sub-configurations where each sub-configuration corresponds to one spatial adaptation pattern.

* FFS: impact on CSI processing requirement

**Agreement@112bis-e**

For CSI report configuration, if L>1 in a CSI report configuration, at least the following can be included for each sub-configuration for Type 1 SD adaptation

* N1, N2 for single-panel and N1, N2, Ng for multi-panel
  + FFS: details on explicit indication or implicit derivation
* Port subset indication when A1-2 is used (if A1-2 is supported)
  + FFS: details on explicit indication or implicit derivation
* FFS: rank restriction
* FFS: codebook subset restriction
* FFS: supported codebook types for PMI, e.g., Type-I or Type-II
* FFS: report quantity
* FFS: reportFreqConfiguration
* FFS: Group identity of NZP CSI-RS resource(s) in a resource set for channel measurement when A1-1 is used

For CSI report configuration for type 2 SD adaptation, further study under which cases sub-configurations may or may not be needed including sub-configuration content

**Agreement@113**

For a CSI report configuration with L>1, for Type 1 SD, at least when A1-2-revised is used for the associated codebook configuration,

* Only common codebook type for PMI across sub-configurations is supported
  + Codebook type-1 for PMI is supported

**Agreement@113**

For Type 1 adaptation, for each sub-configuration,

* Port subset indication is based bitmap is supported
  + - One bit per port for single panel case (i.e. turning off in a port level)
    - FFS: One bit per panel for multi-panel case (i.e. turning off in panel level)
    - Note: It is up to the gNB to ensure the mapping of the bit to a uniform x-pol rectangular array

**Agreement@113**

For Type 1 adaptation, for each sub-configuration, for multi-panel case,

* One bit per port based on bitmap is supported
* Note: It is up to the gNB to ensure the mapping of the bit to a uniform x-pol rectangular array for each of the activated panel(s). Additionally, if more than one panel is activated, uniformity across panels is ensured by the gNB (i.e., the same N1, N2 across multiple activated panels)

**Agreement@113**

For the sub-configuration(s) in a CSI report configuration with L>1,

* for Type 1 SD with A1-2-revised, the following is configured in each sub-configuration
  + - codebook subset restriction,
    - rank restriction
    - N1, N2 and Ng
    - FFS: the case when the number of ports is less than 4
* for Type 2 SD adaptation with A1-1-revised, for each sub-configuration
  + - a list of CSI-RS resource ID
    - FFS: codebookConfig (including codebookSubsetRestriction/ ri-Restriction)
    - FFS: CQI table indication
    - FFS: reportFreqConfiguration
    - FFS: report quantity

Above is agreed in addition to what was agreed in previous RAN1 agreements

**Agreement@114**

* For each sub-configuration in a CSI reportConfig, for Type 1 SD adaptation only, and Type 2 SD adaptation only, support,
  + {codebookConfig (for Type 2 SD only) is common for all sub-configurations
  + {reportQuantity, reportFreqConfiguration} is not configured in any sub-configuration and the legacy/original parameters are used for all sub-configurations.
  + cqi-Table is common for all sub-configurations
  + for indicating # of ports in a port subset = 2, legacy IE twoTX-CodebookSubsetRestriction can be used for this subConfig in Type 1 SD.

**Agreement@114**

For Type 1 SD for multi-panel case,

* Introduce a new mixed codebook combination {Type 1 Single Panel, Type 1 Multi Panel, Null} in R18 for FG *codebookComboParameterAddition* (indicating the UE supports the mixed codebook combinations in a slot)
* Note: gNB can configure either Type 1 single panel codebook or Type 1 multi-panel codebook for a sub-configuration from one or multiple sub-configurations within one CSI report configuration if a UE reports support of multi-panel operation.

**Conclusion@114**

No simultaneous configuration of Type 1 SD and Type 2 SD adaptation in a same CSI report configuration.

**Agreement@115**

For Type 2 SD adaptation or joint operation of Type 2 SD and PD adaptation,

* + - The *non-PMI-PortIndication*, or *typeISinglePanel-codebookSubsetRestriction-i2* can be configured in CSI-ReportConfig instead of in sub-configuration.

**Agreement@115**

**For Type 2 SD only**,

* The list of NZP CSI-RS resources ~~is identical to or~~ has no intersection with the list of NZP CSI-RS resources configured for any other sub-configuration(s) within the CSI-ReportConfig.

**Agreement@115**

**For Type 1 SD adaptation, or joint operation of Type 1 SD and PD adaptation,**

* + - For a CSI report with *reportQuantity* set to 'cri-RI-i1-CQI', UE expects that *typeISinglePanel-codebookSubsetRestriction-i2* to be configured in each sub-configuration that contains *port-subsetIndicator*
    - If there is at least one sub-configuration corresponding to 'typeI-SinglePanel' and at least one sub-configuration corresponding to 'typeI-MultiPanel' in the same CSI report configuration, UE expects that *codebookMode* to be configured in each sub-configuration that contains *port-subsetIndicator*

**Agreement@115**

**For Type 1 SD adaptation, or joint operation of Type 1 SD and PD adaptation**, for a CSI report with *reportQuantity* set to 'cri-RI-CQI',

* + - UE expects that *non-PMI-PortIndication*, if configured, to be configured in each sub-configuration containing port-subsetIndicator
      * Ports selected in the *non-PMI-PortIndication correspond to* enabled ports in the bitmap *port-subsetIndicator*
    - If *non-PMI-PortIndication* is not configured in a sub-configuration, UE applies legacy behavior for the case where *non-PMI-PortIndication* is not configured after re-indexing CSI-RS port indices, by replacing P with the number of enabled ports in the bitmap *port-subsetIndicator* configured for the sub-configuration

**CSI reporting framework**

**Agreement@112**

For spatial domain adaptation, further study necessary enhancements for multiple CSI(s) where each CSI corresponds to a spatial adaptation pattern, e.g.

* FFS: gNB indicates to UE which CSI(s) the UE shall report
* FFS: the UE selects which CSI(s) are reported
* FFS: multiple CSI(s) are reported in a joint CSI report
* FFS: Overhead reduction for multiple CSI(s)

Note: UE complexity needs to be taken into account.

**Agreement@112bis-e**

For a CSI report config with *L* sub-configuration(s), support a framework that enables a UE to report *N* CSI(s) in one reporting instance where the *N* CSI(s) are associated with *N* sub-configuration(s) from *L* (where ) and each CSI corresponds to one sub-configuration.

* For discussion purpose, N=1 refers to single-CSI while N>1 refers to multi-CSI.
* For Semi-persistent/Aperiodic CSI reporting, support gNB trigger/indicate/activate report of N≤L CSIs where N>=1
* The maximum value of N and L are subject to UE capability
* Further study how to address/minimize additional UE complexity

The following bullet not agreed due to objection from Apple and vivo

* For Periodic CSI reporting, at least the case of N=L is supported where N>=1

**Agreement@114bis**

From RAN1 perspective, up to 4 CSI report configurations can be configured in a BWP for SP CSI reporting on PUCCH where one or more report configurations can contain a list of sub-configuration(s)

* Send an LS to RAN2 inlcuding the relevant agreements made in UE feature discussions. Final LS is endorsed in R1-2310578.

**Conclusion@114bis**

There is no consensus on the following proposal:

For a P/SP-CSI report configuration containing a list of *L* sub-configurations, if at least one subConfig (which is the triggered one for SP-CSI reporting, or configured one for P-CSI report) is associated with more than one CSI-RS resource, nCSI\_ref is the smallest value >=5\*2μDL; otherwise, it is the smallest value no smaller than 4\*2μDL

**Agreement@114bis**

For CSI reporting on PUCCH and PUSCH, at least one new table is introduced for the scenarios of Table 6.3.1.1.2-11 and Table 6.3.2.1.2-5 in TS38.212, with update corresponding to the CSI mapping order of part 2 CSI even/odd subbands for CSI reporting corresponding to one or more sub-configurations.

**Agreement@114bis**

Adopt the following TP for TS 38.213.

---------------------------------Start of Text Proposal on TS 38.213 v18.0.0------------------

**9.2.5 UE procedure for reporting multiple UCI types**

< Unchanged parts are omitted >

If a UE would multiplex CSI reports that include Part 2 CSI reports in a PUCCH resource, the UE determines the PUCCH resource and a number of PRBs for the PUCCH resource or a number of Part 2 CSI reports assuming that each of the CSI reports indicates rank 1, or rank combination of {1, 1}, or rank 1 per CSI sub-report, if applicable. If the higher layer parameter *csi-ReportMode* of CSI reports is set to 'Mode2', the UE determines the PUCCH resource and a number of PRBs for the PUCCH resource or a number of Part 2 CSI reports assuming that each CRI in the CSI report is associated with a resource pair.

< Unchanged parts are omitted >

---------------------------------End of Text Proposal on TS 38.213 v18.0.0--------------------

|  |  |
| --- | --- |
| Reason for changes | Clarify the rank assumption for determination of PUCCH resource. |
| Summary of changes | Added the assumed rank for CSI sub-report. |
| Consequences if not approved | Unclear rank assumption when PUCCH resource is to be determined. |
| Note: this table is added by Rapporteur | |

**Agreement@115**

For a CSI report configuration containing a list of sub-configurations, after the CSI report (re)configuration, serving cell activation, BWP change, or activation of SP-CSI, the UE reports a CSI report including one or more sub-reports only after receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement, per sub-configuration, no later than CSI reference resource and drops the report otherwise.

For the above “per sub-configuration”, it is a sub-configuration that is

* Alt 1: the activated/triggered one for SP-CSI reporting

**CSI payload/reportQuantity, UCI mapping**

**Agreement@112bis-e**

* For CSI feedback with CSI overhead/report payload reduction, further study whether/how to report a common value and/or a differential and/or joint coded value across same CSI quantity of different sub-configurations/adaptation patterns, at least for the following
  + CRI
  + RI
  + PMI
  + CQI
  + FFS: L1-RSRP
  + Other (new) report quantity, if any
* Further study whether/how it is feasible/possible for the UE to skip the evaluations of some sub-configurations/adaptation patterns to reduce the burden at the UE

**Agreement@113**

For both spatial domain NES, when UE reports CSIs corresponding to one or more sub-configurations provided in a CSI report configuration,

* At least support baseline: Report CSI for each indicated sub-configuration, according to reportQuantity configuration
  1. FFS: details on how to map CSI(s) in a CSI report
* Further enhancement on CSI payload reduction is not precluded

**Conclusion@114**

* No further enhancements for PMI reduction in R18 NES.
* No further enhancements for RI reduction in R18 NES.
* No support of UE reporting PDSCH power reduction tolerance in R18 NES.

**Agreement@114bis**

Support gNB can configure report quantities of 'cri-RI-i1-CQI', 'cri-RI-CQI', or 'cri-RI-i1'.

**Agreement@114bis**

Report quantities of 'cri-RSRP', 'cri-SINR', or 'cri-SINR- Index ' are NOT applicable to NES

**Agreement@115**

Report quantities of 'cri-RSRP-Index', 'none', 'ssb-Index-RSRP', 'ssb-Index-SINR', 'ssb-Index-RSRP- Index', 'ssb-Index-SINR- Index' or 'tdcp' are NOT applicable to Rel-18 NES.

**Conclusion@114bis**

There is no consensus to support the following:

* A UE only reports PMI in CSI part 2 for the first sub-configuration among the sub-configurations with the same RI reported across sub-configurations.

**Agreement@115**

|  |
| --- |
| * Reason for changes:   + There is no description on the mapping between CRI and CSI-RS resource for a sub-configuration configured with CSI-RS ID list * Summary of changes:   + Add the mapping between CRI and CSI-RS resource for a sub-configuration configured with CSI-RS ID list * Consequences if not approved   + The mapping between CRI and CSI-RS resource for a sub-configuration configured with CSI-RS ID list is unclear   <omitted texts>  If the UE is configured with a *CSI-ReportConfig* that contains a list of sub-configurations, provided by the higher layer parameter [*csi-ReportSubConfigList]*:  - the UE expects to be configured with the higher layer parameter *codebookType* set to 'typeI-SinglePanel' or 'typeI-MultiPanel'. If the UE indicates a capability for supporting mixed codebook combination in a slot with [ABC], each sub-configuration can be configured with the higher layer parameter *codebookType* set to 'typeI-SinglePanel' or 'typeI-MultiPanel'.  - Each sub-configuration can be configured with an antenna port subset using the higher layer bitmap parameter [*port-subsetIndicator*] which contains the bit sequence , where is the MSB and is the LSB, bit corresponds to antenna port , and is the number of ports *nrofPorts* configured for the CSI-RS resources(s) within the *NZP-CSI-RS-ResourceSet* contained in the *CSI-ResourceConfig* for channel measurement that corresponds to the *CSI-ReportConfig*. A bit value 0 in [*port-subsetIndicator*] indicates that the corresponding antenna port is disabled for the sub-configuration, whereas bit value 1 indicates that the antenna port is enabled and belongs to the antenna port subset for the sub-configuration.  - If a sub-configuration is configured with an antenna port subset, then the sub-configuration can be configured with a [RI restriction parameter] and, if the number of antenna ports of the subset greater than 2, with [*n1-n2* parameter] if the higher layer parameter *codebookType* is set to 'typeI-SinglePanel' or with [*ng*-*n1-n2* parameter] if the higher layer parameter *codebookType* is set to 'typeI-MultiPanel', and, if the corresponding number of antenna ports of the subset is 2, with *twoTX-CodebookSubsetRestriction*, where the parameters [RI restriction], [*n1-n2],* [*ng*-*n1-n2],* *twoTX-CodebookSubsetRestriction* are as described in Clauses 5.2.2.2.1 and 5.2.2.2.2.  - A sub-configuration can be configured with a list of NZP CSI-RS resources, provided by [*nzp-CSI-RS-resourceList*], which indicates one or more NZP CSI-RS resources, within the *NZP-CSI-RS-ResourceSet* contained in the *CSI-ResourceConfig* for channel measurement which corresponds to the *CSI-ReportConfig.*  [The list of NZP CSI-RS resources is identical to or has no intersection with a list of NZP CSI-RS resources configured for any other sub-configuration(s) within the *CSI-ReportConfig*.]  - If a sub-configuration is configured with a list of NZP CSI-RS resources with more than one resources, the UE shall derive the CSI parameters other than CRI conditioned on the reported CRI, where the CRI k (k ≥ 0) for the sub-configuration corresponds to the configured (k+1)-th entry of associated nzp-CSI-RS-Resources in the list of NZP CSI-RS resources.  - A sub-configuration can be configured with a power offset provided by [*powerOffse*t].  - If a sub-configurations is not configured with [*nzp-CSI-RS-resourceList*] then the sub-configuration shall be associated with all the NZP CSI-RS resources within the *NZP-CSI-RS-ResourceSet* contained in the *CSI-ResourceConfig* for channel measurement which corresponds to the *CSI-ReportConfig.*  - the UE reports CSI(s) for one or more sub-configurations according to Clauses 5.2.1.5.1, 5.2.1.5.2, 5.2.3 and 5.2.4, and according to the higher layer parameter *reportQuantity* configured for that *CSI-ReportConfig*.  <omitted texts> |

**Agreement@114**

Down-select from the below for priority rule determination for CSI reporting of multiple sub-configurations

* Option 1: The priority of the CSI report containing CSIs for multiple sub-configurations, is determined according to the clause 5.2.5 of TS 38.214.
  + 1-b) A sub-configuration level priority is determined by the order of sub-configuration index. For Part 2 CSI corresponding to each sub-configuration, omission is at subConfig level. Follow legacy dropping rules for a CSI report containing multiple CSIs.
    - CSI mapping rule across sub-configurations follow legacy specification principle
    - Sub-configuration index with lower value has higher priority
    - Sub-configuration index is configured in CSI report config

**Agreement@114**

For CSIs across multiple sub-configurations in one CSI reportConfig map different sub-configurations based on RAN1#114 agreement in 9.7.1

* For Part 2 priority reporting level
  + Option 1: for a given band type from {wideband, even subband, odd subband}, the omission order follows the priority order determined by sub-configuration index

**Agreement@114**

For N(>1) CSIs reporting with multiple sub-configurations without payload/complexity reduction,

* Each CSI can be a single-part, or two-part CSI, and contains the same types of CSI parameters/quantities as legacy, when applicable/if reported;
* The mapping order of CSI fields of one sub-configuration is as legacy mapping order of CSI fields of one CSI report;
* Part 2 CSI priority reporting level follows wideband CSI first, then even subband CSI and odd subband CSI;

**Agreement@114bis**

For CSI mapping of subbands for a CSI report having multiple sub-configurations, odd sub-band CSI(s) of all sub-configurations in one multi-CSI reporting are mapped after all even sub-band CSI(s) in one multi-CSI reporting.



**Conclusion@114bis**

No consensus to have spec update with respect to the issue 6 in R1-2310307.

**Agreement@114bis**

For a CSI report having sub-configuration including port subset indication, CSI-RS port re-indexing is supported.

**Agreement@114bis**

Adopt the following TP for TS 38.214 for the above agreements

**5.2.1.4.2 Report Quantity Configurations**

---------------------------------------------------- Unchanged text is omitted ---------------------------------------------------------

If the UE is configured with a *CSI-ReportConfig* that contains a list of sub-configurations, provided by the higher layer parameter [*csi-ReportSubConfigList]*:

* ~~t~~The UE expects to be configured with the higher layer parameter *codebookType* set to 'typeI-SinglePanel' or 'typeI-MultiPanel'. If the UE indicates a capability for supporting mixed codebook combination in a slot with [ABC], each sub-configuration can be configured with the higher layer parameter *codebookType* set to 'typeI-SinglePanel' or 'typeI-MultiPanel'.
* ~~-~~ Each sub-configuration can be configured with an antenna port subset using the higher layer bitmap parameter [*port-subsetIndicator*] which contains the bit sequence , where is the MSB and is the LSB, bit corresponds to antenna port , and is the number of ports *nrofPorts* configured for the CSI-RS resources(s) within the *NZP-CSI-RS-ResourceSet* contained in the *CSI-ResourceConfig* for channel measurement that corresponds to the *CSI-ReportConfig*. A bit value 0 in [*port-subsetIndicator*] indicates that the corresponding antenna port is disabled for the sub-configuration, whereas bit value 1 indicates that the antenna port is enabled and belongs to the antenna port subset for the sub-configuration. For the derivation of PMI, antenna ports corresponding to all bits with value of 1 in [*port-subsetIndicator*] are mapped to consecutive antenna ports starting at CSI-RS antenna port 3000 in increasing order of the bit position in [*port-subsetIndicator*].



---------------------------------------------------- Unchanged text is omitted -------------------------------------------------------

|  |  |
| --- | --- |
| Reason for changes | To enable contiguous antenna port indexing for PMI derivation for Type 1 SD with port subset indication. |
| Summary of changes | Port re-indexing procedure is added. |
| Consequences if not approved | Antenna port will be non-consecutive which cause misalignment for PMI derivation. |
| Note: this table is added by Rapporteur | |

**Agreement@115**

For a CSI report containing Type 1 SD sub-configuration(s), support port re-indexing to enable consecutive port indices for CQI calculation purpose.

**Agreement@114bis**

* Reason for changes
  + Current text incorrectly implies that all CSI reports contain sub-reports
  + Variable used for number of CSI sub-reports is incorrect
  + Current text “upper part to lower part” does not accurate in the context of sub-reports when not all CSI reports necessarily contain sub-reports, which should be a segment of the UCI sequence only for the corresponding sub-report(s)
* Summary of changes
  + Changes to note in Tables 6.3.1.1.2-13, 6.3.1.1.2-14, 6.3.2.1.2-6, and 6.3.2.1.2-7 to fix the above issues
* Consequences if not approved
  + Incorrect CSI mapping to UCI bit sequence for both CSI on PUCCH and PUSCH

------------------------------ Text Proposal (TP#1) for 38.212, Sections 6.3.1.1.2 and 6.3.2.1.2 --------------------------

\*\*\* Unchanged text omitted \*\*\*

If none of the CSI reports for transmission on a PUCCH is of two parts, the CSI fields of all CSI reports, in the order from upper part to lower part in Table 6.3.1.1.2-12, are mapped to the UCI bit sequence  starting with . The most significant bit of each field is mapped to the lowest order information bit for that field, e.g. the most significant bit of the first field is mapped to.

**Table 6.3.1.1.2-12: Mapping order of CSI reports to UCI bit sequence , without two-part CSI report(s)**

|  |  |
| --- | --- |
| **UCI bit sequence** | **CSI report number** |
|  | CSI report #1  as in Table 6.3.1.1.2-7/7A/8/8B |
| CSI report #2  as in Table 6.3.1.1.2-7/7A/8/8B |
| … |
| CSI report #n  as in Table 6.3.1.1.2-7/7A/8/8B |
| Note: For a CSI report #i containing *Ni*CSI sub-reports, where ~~i=1,2,…,n~~, all CSI sub-reports within the CSI report #i are mapped to the corresponding ~~part~~ segment of the UCI bit sequence of CSI report #i, from upper part to lower part of the segment, in increasing order of CSI sub-report number. CSI sub-report #1, CSI sub-report #2, …, CSI sub-report #~~n~~*Ni* correspond to the CSI sub-reports in increasing order of *CSI-ReportSubConfigID*. | |

If at least one of the CSI reports for transmission on a PUCCH is of two parts, two UCI bit sequences are generated,  and . The CSI fields of all CSI reports, in the order from upper part to lower part in Table 6.3.1.1.2-13, are mapped to the UCI bit sequence  starting with . The most significant bit of each field is mapped to the lowest order information bit for that field, e.g. the most significant bit of the first field is mapped to. The CSI fields of all CSI reports, in the order from upper part to lower part in Table 6.3.1.1.2-14, are mapped to the UCI bit sequence  starting with . The most significant bit of each field is mapped to the lowest order information bit for that field, e.g. the most significant bit of the first field is mapped to . If the length of UCI bit sequence  is less than 3 bits, zeros shall be appended to the UCI bit sequence until its length equals 3.

**Table 6.3.1.1.2-13: Mapping order of CSI reports to UCI bit sequence ,   
with two-part CSI report(s)**

|  |  |
| --- | --- |
| **UCI bit sequence** | **CSI report number** |
|  | CSI report #1 if CSI report #1 is not of two parts, or  CSI report #1, CSI part 1, if CSI report #1 is of two parts,  as in Table 6.3.1.1.2-7/7A/8/8B/9/9A/9B |
| CSI report #2 if CSI report #2 is not of two parts, or  CSI report #2, CSI part 1, if CSI report #2 is of two parts,  as in Table 6.3.1.1.2-7/7A/8/8B/9/9A/9B |
| … |
| CSI report #n if CSI report #n is not of two parts, or  CSI report #n, CSI part 1, if CSI report #n is of two parts,  as in Table 6.3.1.1.2-7/7A/8/8B/9/9A/9B |
| Note: For a CSI report #i containing *Ni* CSI sub-reports, where ~~i=1,2,…,n~~, either all CSI sub-reports not of two parts or CSI part 1 of all CSI sub-reports of two parts, ~~either a CSI sub-report without two-part, or CSI part 1 of a CSI sub-report with two-part CSI,~~ are mapped to the corresponding ~~part~~ segment of the UCI bit sequence of CSI report #i, from upper part to lower part of the segment, in increasing order of CSI sub-report number. CSI sub-report #1, CSI sub-report #2, …, CSI sub-report #~~n~~*Ni* correspond to the CSI sub-reports in increasing order of *CSI-ReportSubConfigID*. | |

where CSI report #1, CSI report #2, …, CSI report #n in Table 6.3.1.1.2-13 correspond to the CSI reports in increasing order of CSI report priority values according to Clause 5.2.5 of [6, TS38.214].

**Table 6.3.1.1.2-14: Mapping order of CSI reports to UCI bit sequence ,   
with two-part CSI report(s)**

|  |  |
| --- | --- |
| **UCI bit sequence** | **CSI report number** |
|  | CSI report #1, CSI part 2 wideband, as in Table 6.3.1.1.2-10/10A/10B if CSI part 2 exists for CSI report #1 |
| CSI report #2, CSI part 2 wideband, as in Table 6.3.1.1.2-10/10A/10B if CSI part 2 exists for CSI report #2 |
| … |
| CSI report #n, CSI part 2 wideband, as in Table 6.3.1.1.2-10/10A/10B if CSI part 2 exists for CSI report #n |
| CSI report #1, CSI part 2 subband, as in Table 6.3.1.1.2-11/11A/11B/[New Table] if CSI part 2 exists for CSI report #1 |
| CSI report #2, CSI part 2 subband, as in Table 6.3.1.1.2-11/11A/11B/[New Table] if CSI part 2 exists for CSI report #2 |
| … |
| CSI report #n, CSI part 2 subband, as in Table 6.3.1.1.2-11/11A/11B/[New Table] if CSI part 2 exists for CSI report #n |
| Note: For a CSI report #i containing *Ni* CSI sub-reports, where ~~i=1,2,…,n~~,   * ~~all the~~ CSI part 2 wideband~~s~~ of all CSI sub-reports are mapped to the corresponding ~~part~~ segment of the UCI bit sequence of CSI report #i, from upper part to lower part of the segment, in increasing order of CSI sub-report number; * CSI sub-report #1, CSI sub-report #2, …, CSI sub-report #~~n~~*Ni* correspond to the CSI sub-reports in increasing order of *CSI-ReportSubConfigID*. | |

where CSI report #1, CSI report #2, …, CSI report #n in Table 6.3.1.1.2-14 correspond to the CSI reports in increasing order of CSI report priority values according to Clause 5.2.5 of [6, TS38.214].

\*\*\* Unchanged text omitted \*\*\*

**Table 6.3.2.1.2-6: Mapping order of CSI reports to UCI bit sequence ,   
with two-part CSI report(s)**

|  |  |
| --- | --- |
| **UCI bit sequence** | **CSI report number** |
|  | CSI part 1 of CSI report #1 as in Table 6.3.2.1.2-3/3A/3B or Table 6.3.1.1.2-8/8A/8B |
| CSI part 1 of CSI report #2 as in Table 6.3.2.1.2-3/3A/3B or Table 6.3.1.1.2-8/8A/8B |
| … |
| CSI part 1 of CSI report #n as in Table 6.3.2.1.2-3/3A/3B or Table 6.3.1.1.2-8/8A/8B |
| Note: For a CSI report #i containing *Ni* CSI sub-reports, where ~~i=1,2,…,n~~, CSI part 1 of all CSI sub-reports are mapped to the corresponding ~~part~~ segment of the UCI bit sequence of CSI report #i, from upper part to lower part of the segment, in increasing order of CSI sub-report number. CSI sub-report #1, CSI sub-report #2, …, CSI sub-report #~~n~~ *Ni* correspond to the CSI sub-reports in increasing order of *CSI-ReportSubConfigID*. | |

where CSI report #1, CSI report #2, …, CSI report #n in Table 6.3.2.1.2-6 correspond to the CSI reports in increasing order of CSI report priority values according to Clause 5.2.5 of [6, TS38.214].

**Table 6.3.2.1.2-7: Mapping order of CSI reports to UCI bit sequence ,   
with two-part CSI report(s)**

|  |  |
| --- | --- |
| **UCI bit sequence** | **CSI report number** |
|  | CSI report #1, CSI part 2 wideband, as in Table 6.3.2.1.2-4/4A/4B,  or CSI part 2 with group 0, as in Table 6.3.2.1.2-5A/5B, if CSI part 2 exists for CSI report #1 |
| CSI report #2, CSI part 2 wideband, as in Table 6.3.2.1.2-4/4A/4B,  or CSI part 2 with group 0, as in Table 6.3.2.1.2-5A/5B, if CSI part 2 exists for CSI report #2 |
| … |
| CSI report #n, CSI part 2 wideband, as in Table 6.3.2.1.2-4/4A/4B,  or CSI part 2 with group 0, as in Table 6.3.2.1.2-5A/5B, if CSI part 2 exists for CSI report #n |
| CSI report #1, CSI part 2 subband, as in Table 6.3.2.1.2-5/5C/5D/[New Table],  or CSI part 2 with group 1 and 2, as in Table 6.3.2.1.2-5A/5B, if CSI part 2 exists for CSI report #1 |
| CSI report #2, CSI part 2 subband, as in Table 6.3.2.1.2-5/5C/5D/[New Table],  or CSI part 2 with group 1 and 2, as in Table 6.3.2.1.2-5A/5B,  if CSI part 2 exists for CSI report #2 |
| … |
| CSI report #n, CSI part 2 subband, as in Table 6.3.2.1.2-5/5C/5D/[New Table],  or CSI part 2 with group 1 and 2, as in Table 6.3.2.1.2-5A/5B,  if CSI part 2 exists for CSI report #n |
| Note: For a CSI report #i containing *Ni* CSI sub-reports, where ~~i=1,2,…,n~~,   * CSI part 2 wideband of all CSI sub-reports are mapped to the corresponding ~~part~~ segment of the UCI bit sequence of CSI report #i, from upper part to lower part of the segment, in increasing order of CSI sub-report number; * CSI sub-report #1, CSI sub-report #2, …, CSI sub-report # ~~n~~ *Ni* correspond to the CSI sub-reports in increasing order of *CSI-ReportSubConfigID*. | |

where CSI report #1, CSI report #2, …, CSI report #n in Table 6.3.2.1.2-7 correspond to the CSI reports in increasing order of CSI report priority values according to Clause 5.2.5 of [6, TS38.214].

\*\*\* Unchanged text omitted \*\*\*

---------------------------------------------------------- End Text Proposal --------------------------------------------------------

**Conclusion@115**

For CSI report with multiple sub-configurations,

* When a CSI report with only one part/part 1 CSI is determined as the lowest priority and to be omitted, the one part/part1 CSI corresponding to all sub-configurations is dropped together

**Agreement@115**

For CPU occupation time for CSI report with one or more sub-configurations,

* For periodic CSI report which contains a list of sub-configurations,
  + It occupies CPU(s) from the first symbol of the earliest one of each CSI-RS/CSI-IM~~/SSB~~ resource for channel or interference measurement within all L configured sub-configurations, respective latest CSI-RS/CSI-IM~~/SSB~~ occasion no later than the corresponding CSI reference resource, until the last symbol of the configured PUSCH/PUCCH carrying the report.
* For semi-persistent CSI report on PUSCH (excluding an initial semi-persistent CSI report on PUSCH after the PDCCH triggering the report) or semi-persistent CSI report on PUCCH which contains a list of sub-configurations
  + It occupies CPU(s) from the first symbol of the earliest one of each CSI-RS/CSI-IM~~/SSB~~ resource for channel or interference measurement within N triggered sub-configurations, until the last symbol of the configured PUSCH/PUCCH carrying the report.

For CSI computation time (Z2, Z2’),

* For a CSI-ReportConfig with sub-configurations, the definition of the corresponding CSI computation time is based on the CSI-RS resources for channel measurement, the CSI-RS resources for interference measurement and the CSI-IM resources for all triggered sub-configurations for AP-CSI report.

Editors to draft TP if needed.

**Agreement@115**

Adpot the following TP for TS 38.214, 5.2.1.4.2

|  |
| --- |
| * Reason for changes:   + The Rel-18 spec in Section 5.2.1.4.2 seems to limit a CSI-ReportConfig to be associated with only a single CSI-RS resource set the due to the word “the” in the text * Summary of changes:   + Remove the restriction for the association of single resource set * Consequences if not approved   + The association of resource set and reportConfig is single, which is against legacy function   5.2.1.4.2 Report quantity configurations  \*\*\* Text omitted \*\*\*  If the UE is configured with a *CSI-ReportConfig* that contains a list of sub-configurations, provided by the higher layer parameter [*csi-ReportSubConfigList]*:  - the UE expects to be configured with the higher layer parameter *codebookType* set to 'typeI-SinglePanel' or 'typeI-MultiPanel'. If the UE indicates a capability for supporting mixed codebook combination in a slot with [ABC], each sub-configuration can be configured with the higher layer parameter *codebookType* set to 'typeI-SinglePanel' or 'typeI-MultiPanel'.  - Each sub-configuration can be configured with an antenna port subset using the higher layer bitmap parameter [*port-subsetIndicator*] which contains the bit sequence , where is the MSB and is the LSB, bit corresponds to antenna port , and is the number of ports *nrofPorts* configured for the CSI-RS resources(s) within a *NZP-CSI-RS-ResourceSet* contained in the *CSI-ResourceConfig* for channel measurement that corresponds to the *CSI-ReportConfig*. A bit value 0 in [*port-subsetIndicator*] indicates that the corresponding antenna port is disabled for the sub-configuration, whereas bit value 1 indicates that the antenna port is enabled and belongs to the antenna port subset for the sub-configuration.  - If a sub-configuration is configured with an antenna port subset, then the sub-configuration can be configured with a [RI restriction parameter] and, if the number of antenna ports of the subset greater than 2, with [*n1-n2* parameter] if the higher layer parameter *codebookType* is set to 'typeI-SinglePanel' or with [*ng*-*n1-n2* parameter] if the higher layer parameter *codebookType* is set to 'typeI-MultiPanel', and, if the corresponding number of antenna ports of the subset is 2, with *twoTX-CodebookSubsetRestriction*, where the parameters [RI restriction], [*n1-n2],* [*ng*-*n1-n2],* *twoTX-CodebookSubsetRestriction* are as described in Clauses 5.2.2.2.1 and 5.2.2.2.2.  - A sub-configuration can be configured with a list of NZP CSI-RS resources, provided by [*nzp-CSI-RS-resourceList*], which indicates one or more NZP CSI-RS resources, within a *NZP-CSI-RS-ResourceSet* contained in the *CSI-ResourceConfig* for channel measurement which corresponds to the *CSI-ReportConfig.*  [The list of NZP CSI-RS resources is identical to or has no intersection with a list of NZP CSI-RS resources configured for any other sub-configuration(s) within the *CSI-ReportConfig*.]  - A sub-configuration can be configured with a power offset provided by [*powerOffse*t].  - If a sub-configuration is not configured with [*nzp-CSI-RS-resourceList*] then the sub-configuration shall be associated with all the NZP CSI-RS resources within a *NZP-CSI-RS-ResourceSet* contained in the *CSI-ResourceConfig* for channel measurement which corresponds to the *CSI-ReportConfig.*  - the UE reports CSI(s) for one or more sub-configurations according to Clauses 5.2.1.5.1, 5.2.1.5.2, 5.2.3 and 5.2.4, and according to the higher layer parameter *reportQuantity* configured for that *CSI-ReportConfig*.  \*\*\* Text omitted \*\*\* |

**CPU/active resource/antenna ports counting**

**Agreement@113**

For spatial domain adaptation or power domain adaptation, for CSIs reporting corresponding to N indicated sub-configurations from L sub-configurations in a CSI report, for the case without CSI payload reduction

* , where is the total number of CSI-RS resources corresponding to i-th sub-configuration in the CSI-RS resource set for channel measurement.
  + the summation is over N for A-CSI RS
  + This is for CSI processing criteria for NES in Clause 5.2.1.6 of TS 38.214

**Agreement@113**

Alt 2: For P-CSI reporting from L configured sub-configurations, support:

* All L configured sub-configurations are reported in every periodic occasion.
* The maximum value of L can be different for A-CSI, SP-CSI, and P-CSI.
* , where is the total number of CSI-RS resources corresponding to i-th sub-configuration in the CSI-RS resource set for channel measurement. (N=L in the equation)
* FFS: Details on active CSI-RS resource / port counting

**Agreement@114**

For SD and/or PD adaptation without UE complexity reduction, CPU counting of A/SP-CSI reporting is based on for CSIs reporting corresponding to N indicated sub-configurations from L configured sub-configurations in a CSI report.

**Agreement@114**

For a CSI report configuration containing sub-configuration(s), if a CSI-RS resource is referred by M sub-configurations among X sub-configurations, the CSI-RS resource is counted M times and CSI-RS ports within the CSI-RS resource are counted by

* Option 2A: for Type 1 SD adaptation, and for Type 2 SD or PD adaptation.
* is nrofPorts configured in NZP-CSI-RS-Resource and is the number of CSI-RS ports in sub-configuration s derived from port subset indication.
* It is understood that further discussions are necessary.

**Agreement@114bis**

* For a CSI report config containing sub-configuration(s), support in Table 5.4-2 of TS 38.214 for CSI computation delay requirements.



* For CPU occupation and update, if there are not enough CPUs for processing the entire CSI report, legacy UE behavior is used

Only Z2, Z2’ will be supported.

**Agreement@114bis**

* For CSI reporting in PUCCH, Table 6.3.1.1.2-7, Table 6.3.1.1.2-9 and Table 6.3.1.1.2-10 in TS38.212 are applicable for NES
* For CSI reporting on PUSCH, Table 6.3.2.1.2-3 and Table 6.3.2.1.2-4 in TS38.212 are applicable for NES
* Further discuss in this meeting about the applicability of below for NES
  + Table 6.3.1.1.2-8/8A/11 in TS38.212 (or a new table for replacement of Table 6.3.1.1.2-11)
  + Table 6.3.2.1.2-5 in TS38.212 (or a new table for replacement)

**Agreement@115**

|  |
| --- |
| **Reason for change:**   * The definition of X sub-configuration is not clear. * The SD and PD joint operation case Is not counted |
| **Summary of change:**   * Clarified the definition of X sub-configurations. * Added the counting rule for consideration of SD and PD joint operation |
| **Consequences if not approved:**   * The result of CSI-RS resource/port counting for CSI report configuration containing sub-configurations is not clear. * The counting rule is not clear when PD adaptation is jointly operated |
| -----------------------------------------------------------Text proposal -----------------------------------------------------------  5.2.1.6 CSI processing criteria  <omitted text>  In any slot, the UE is not expected to have more active CSI-RS ports or active CSI-RS resources in active BWPs than reported as capability. NZP CSI-RS resource is active in a duration of time defined as follows. For aperiodic CSI-RS, starting from the end of the PDCCH containing the request and ending at the end of the scheduled PUSCH containing the report associated with this aperiodic CSI-RS. When the PDCCH candidates are associated with a search space set configured with *searchSpaceLinking*, for the purpose of determining the NZP CSI-RS resource active duration, the PDCCH candidate that ends later in time among the two linked PDCCH candidates is used. For semi-persistent CSI-RS, starting from the end of when the activation command is applied, and ending at the end of when the deactivation command is applied. For periodic CSI-RS, starting when the periodic CSI-RS is configured by higher layer signalling, and ending when the periodic CSI-RS configuration is released. If a CSI-RS resource is referred *N* times by one or more CSI Reporting Settings not configured with higher layer parameter [*csi-ReportSubConfigList*], the CSI-RS resource and the CSI-RS ports within the CSI-RS resource are counted *N* times. For a CSI-RS Resource Set for channel measurement configured with two Resource Groups and Resource Pairs, if a CSI-RS resource is referred times by one of the CSI-RS resources, where is defined in clause 5.2.1.4.2, and/or one or two Resource Pairs, the CSI-RS resource and the CSI-RS ports within the CSI-RS resource are counted times.  For a ~~CSI report configuration~~ *CSI-ReportConfig* containing a list of *L* sub-configuration(s) ~~indicated in a~~ *~~CSI-ReportConfig~~* provided by higher layer parameter [*csi-ReportSubConfigList*]*,* if a CSI-RS resource is referred by *M* sub-configurations among *~~X~~N* triggered sub-configurations for CSI reporting for aperiodic CSI-RS resource, or *L* configured sub-configurations for CSI reporting for semi-persistent CSI-RS resource or periodic CSI-RS resource, the CSI-RS resource is counted *M* times and the CSI-RS ports within the CSI-RS resource are counted as follows:  ~~-~~  ~~if each sub-configuration, of the~~ *~~M~~* ~~sub-configurations, is configured with a CSI-RS antenna port subset, provided by [~~*~~port-subsetIndicator~~*~~], or is configured with a list of one or more CSI-RS resources, provided by [nzp-CSI-RS-resourceList], or is configured with a power offset, provided by [powerOffset],~~  ~~-~~ *~~M~~* ~~×~~ *~~P~~* ~~if each sub-configuration, of the~~ *~~M~~* ~~sub-configurations, is configured with a list of one or more CSI-RS resources, provided by [~~*~~nzp-CSI-RS-resourceList~~*~~], [and/] or is configured with a power offset, provided by~~ *~~[powerOffset]~~*~~,~~  Where *P* is the number of ports configured by *nrofPorts* and is the number of CSI-RS ports in sub-configuration *s* derived from the corresponding antenna port subset indicator [*port-subsetIndicator*] according to clause 5.2.1.4.2 if configured, otherwise equals to *P*.  <omitted text>  -------------------------------------------------------End of Text proposal ------------------------------------------------------ |

**Power domain (PD) adaptation and joint operation**

**Agreement@112**

For adaptation of power offset values between PDSCH and CSI-RS, further study the following

* Where/how to configure multiple power offset values
  + Whether/how one or more power offset values are dynamically indicated to UE for CSI measurement/reporting, and PDSCH reception
  + Overhead reduction for CSI reports associated with multiple power offset values between PDSCH and CSI-RS
  + Whether other UE report content can be included

**Agreement@112bis-e**

For power domain adaptation, for CSI(s) reporting, support configuration of more than one power offset values for PDSCH relative to CSI-RS

* FFS: impact on CSI processing requirement
* FFS: details on configuration/indication of the power offset values
* FFS: whether/how to additionally consider the case where CSI-RS power is changed

**Agreement@112bis-e**

For power domain adaptation, support the following configuration(s) for CSI-RS resource configuration,

* A1-2-power: one or more resources can be configured in a resource set within a resource setting and each resource can be associated with one or more power offset values
* FFS: A1-1-power: a resource set with multiple resources is configured within a resource setting, where resources can have different power offset values
* FFS: Details of how the different power offset values(s) are configured/indicated.

**Agreement@113**

Joint operation of SD and PD adaptation is supported.

**Agreement@114**

For power domain adaptation only, all CSI-RS resource(s) (which can be one or more) in the CSI-RS resource set for channel measurement are associated with each sub-configuration provided in a CSI report configuration

* Each sub-configuration contains an offset value (e.g. X) that is commonly applied to all the resources within the resource set. For a CSI-RS resource in CSI resource configuration, the *PDSCH to CSI-RS EPRE offset* (e.g. Y) for CSI calculation is determined based on *powerControlOffset* (e.g. Z) value in CSI resource configuration and the offset value configured in CSI sub-configuration in the report configuration.
  + Only legacy values are applicable for the resulted power control offset values
  + It is expected that the sub-configuration leads to a value no larger than power control offset value provided in CSI resource configuration

**Agreement@114**

For joint operation of SD and PD, each subConfig contains corresponding parameters for an SD adaptation and/or parameters for a PD adaptation.

**Agreement@114bis**

Remove the square brackets as below for TS 38.214

|  |
| --- |
| **5.2.2.5 CSI reference resource definition**  <omitted text>  - if a sub-configuration indicates a power offset *[powerOffset]*,for CQI calculation, the UE shall assume the corresponding PDSCH signals transmitted on the antenna ports of a CSI-RS resource would have a ratio of EPRE to CSI-RS EPRE equal to the ~~[~~difference~~]~~ between *powerControlOffset* of the CSI-RS resource, given in Clause 5.2.2.3.1, and *[powerOffset]* ~~[~~, where the differenceis expected to take one of the values that can be configured for *powerControlOffset* of the CSI-RS resource, given in Clause 5.2.2.3.1, and is also expected to take a value that is no larger than the value of *powerControlOffset*~~]~~*.*  <omitted text> |

* The range of [powerOffset] in the above TP is [0…23] in dB with step size of 1 dB.

**Agreement@114bis**

Adopt the following TP for TS 38.214, Clause 5.2.1.1

=== start of TP===

The time domain behavior of the *CSI-ReportConfig* is indicated by the higher layer parameter *reportConfigType* and can be set to 'aperiodic', 'semiPersistentOnPUCCH', 'semiPersistentOnPUSCH', or 'periodic'. For 'periodic' and 'semiPersistentOnPUCCH'/'semiPersistentOnPUSCH' CSI reporting, the configured periodicity and slot offset applies in the numerology of the UL BWP in which the CSI report is configured to be transmitted on. The higher layer parameter *reportQuantity* indicates the CSI-related, L1-RSRP-related, L1-SINR-related, CapabilityIndex-related or TDCP-related quantities to report. The *reportFreqConfiguration* indicates the reporting granularity in the frequency domain, including the CSI reporting band and if PMI/CQI reporting is wideband or sub-band. The *timeRestrictionForChannelMeasurements* parameter in *CSI-ReportConfig* can be configured to enable time domain restriction for channel measurements and *timeRestrictionForInterferenceMeasurements* can be configured to enable time domain restriction for interference measurements. The *CSI-ReportConfig* can also contain *CodebookConfig*, which contains configuration parameters for Type-I, Type II, Enhanced Type II CSI, Further Enhanced Type II Port Selection, Enhanced Type II for coherent joint transmission (CJT), Further Enhanced Type II Port Selection for CJT, Enhanced Type II for predicted PMI, or Further Enhanced Type II Port Selection for predicted PMI including codebook subset restriction when applicable, and configurations of group-based reporting. A UE is not expected to be configured with a CSI report setting associated with a dormant DL BWP if the *reportConfigType* is set to 'aperiodic'. A *CSI-ReportConfig* can contain a list of sub-configurations, provided by the higher layer parameter [*csi-ReportSubConfigList],* where each sub-configuration is identified by [*csi-ReportSubConfigID*] and corresponds to a list of one or more CSI-RS resources or corresponds to a CSI-RS antenna port subset, and/or corresponds to a power offset for PDSCH relative to CSI-RS additional to *powerControlOffset* of the CSI-RS resource. A UE is not expected to be configured with a *CSI-ReportConfig* that contains a mix of sub-configuration(s) each corresponding to a list of one or more CSI-RS resources and some other sub-configuration(s) each corresponding to CSI-RS antenna port subset.

=== end of TP===

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| Reason for changes | Clarify that the power offset is an additional RRC parameter, i.e. not the parameter PowerControlOffset thus not the power of PDSCH relative to CSI-RS. |
| Summary of changes | Adding clarification. |
| Consequences if not approved | There can be misunderstanding that the powerOffset is used as replacement of PowerControlOffset |
| Note: this table is added by Rapporteur | |

**Interference measurement**

**Agreement@115**

* CSI-IM is supported for Rel-18 NES without need of spec update, i.e. resource-wise association is maintained between NZP CSI-RS for CM and CSI-IM.
* NZP CSI-RS for IM is supported for Rel-18 NES
  + Above applies only for
    - the case of PD only adaptation with a single CSI-RS resource for channel measurement

**L1 signaling aspects**

**Agreement@112**

Discuss the signalling aspects for spatial/power domain adaptation for Rel-18 NES-capable UEs considering that

* Whether there is a need for transition time per adaptation (for UE)
* Whether/How to inform UE on spatial adaptation pattern update and/or PDSCH/CSI-RS transmission power change due to adaptation.

**Agreement@112bis-e**

For Semi-persistent/Aperiodic CSI reporting with , study what enhancements to the current DCI and MAC-CE mechanisms are needed for gNB triggering/indication/activation of the N CSI(s) in a reporting instance, where the N CSI(s) are associated with N sub-configuration(s) from L in a report config.

**Agreement@113**

For N>=1 CSI reporting corresponding to N out of L sub-configurations in one reportConfig where each sub-configuration corresponding to an SD adaptation pattern or/[and] a powerControlOffset value,

* For A-CSI and SP-CSI on PUSCH report, support DCI-based triggering
  + For A-CSI-RS, CPU and CSI-RS resource/port counting depend on N indicated sub-configurations
    - FFS: How to do the counting
  + FFS: For P-CSI-RS/SP-CSI-RS, CPU and CSI-RS resource/port counting depend on L or N sub-configurations
* For SP-CSI on PUCCH report, support MAC-CE-based triggering
  + FFS: For P-CSI-RS/SP-CSI-RS, CPU and CSI-RS resource/port counting depend on L or N sub-configurations

Note: UE complexity reduction is not precluded

* For DCI-based triggering,
  + Alt 1: A triggering state corresponding to N sub-configurations is indicated via the existing CSI request field in DCI. Different triggering states could represent different subsets of L sub-configurations.
    - The DCI is UE specific (in this case, legacy DCI format applies)
* For MAC-CE based triggering
  + Opt 2: An indication to select to N sub-configurations in a MAC-CE is supported
    - It is up to RAN2 to decide the signaling designs of the MAC-CE (including whether it is a new MAC CE or an existing MAC CE)
    - Only one MAC CE is used for this triggering

**Agreement@114**

For sub-configuration triggering of A-CSI, an indication for N sub-configurations out of L sub-configurations for a triggering state is configured in *CSI-AssociatedReportConfigInfo*.

* No change to current CSI request field in DCI.

**Agreement@114**

For sub-configuration triggering of SP-CSI on PUSCH report, an indication for N sub-configurations out of L sub-configurations for a triggering state is configured in *CSI-SemiPersistentOnPUSCH-TriggerState*.

* No change to current CSI request field in DCI.

**Conclusion@114**

There is no consensus to support the following:

Option 1: support indication of spatial and/or transmission power adaptation in one of the following approaches (same approach for SD and PD adaptation) in addition to the agreed triggering/activation signalling

* Alt 1: MAC-CE/RRC for indication of corresponding subConfig ID that gNB has applied as adaptation
  + Note: need to take this RAN2 LS in [R1-2306380](file:///C:\Users\younsun\Documents\3GPP%20documents\RAN1%20tdocs\TSGR1_114\Docs\R1-2306380.zip) into account
* Alt 2: UE specific DCI
  + A new field in existing non-fallback UE specific DCI formats is introduced
    - If agreed, the number of bits are to be discussed at CR stage.

**BM/TCI states related aspects**

**Agreement@113**

* Downselect one of the following for BM enhancements in RAN1#114
  + - Case 1: Support scaling the threshold of beam failure detection and threshold of candidate beam identification for power domain network energy saving
    - Case 2: Support UE to send hypothetical beam failure and/or radio link failure (RLF) reports for the indicated hypothetical power offset values.
    - Case 3: No further work on BM enhancements
* Downselect one of the following for TCI configuration enhancement in RAN1#114
  + - Method 1: Configure multiple candidate CSI-RS resources as reference signal for QCL information or for spatial relation information, and switch one of them based on L1/L2 signaling
    - Method 2: Configure multiple candidate sets of TCI state(s) associated with DL/UL signal/channel and switch one of them based on L1/L2 signaling
    - Method 3: No further work on TCI configuration enhancement

**Conclusion@114**

* No further work on BM enhancements for R18 NES.
* No further work on TCI configuration enhancement for R18 NES.

**Other logistics for SD/PD adaptation**

**Agreement@112**

For spatial and power domain adaptation, solution(s) based on adaptation within an active BWP is considered as baseline

**Conclusion@115**

The powerControlOffset configured in TRS still indicates the power offset between PDSCH and TRS.

* New L1 signalling is not introduced
* No spec impact is needed

**Conclusion@115**

NC-JT operation is not applicable for Rel-18 NES

* No further spec impact is needed

**Agreement@115**

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| * Reason for changes   + Terminology of CSIs between 38.214 and 38.212 is misaligned for the description of CSI Part 2 omission * Summary of changes   + Change “CSIs” in 38.214 to “CSI sub-reports” * Consequences if not approved   + Inconsistent terminology between different specifications for description of CSI Part 2 omission   -------------------------------- Text Proposal for 38.214, Section 5.2.3 and 5.2.4 -----------------------------------  \*\*\* Unchanged text omitted \*\*\*  5.2.3 CSI reporting using PUSCH  \*\*\* Unchanged text omitted \*\*\*  For both Type I and Type II reports configured for PUCCH but transmitted on PUSCH, the determination of the payload for CSI part 1 and CSI part 2 follows that of PUCCH as described in Clause 5.2.4.  When CSI reporting on PUSCH comprises two parts, the UE may omit a portion of the Part 2 CSI. Omission of Part 2 CSI is according to the priority order shown in Table 5.2.3-1, where  is the number of CSI reports configured to be carried on the PUSCH. Priority 0 is the highest priority and priority  is the lowest priority and the CSI report *n* corresponds to the CSI report with the *n*th smallest Prii,CSI(*y,k,c,s*) value among the  CSI reports as defined in Clause 5.2.5. The subbands for a given CSI report *n* indicated by the higher layer parameter *csi-ReportingBand* with value '1' are numbered continuously in increasing order with the lowest subband of *csi-ReportingBand* with value set to '1' as subband 0. When omitting Part 2 CSI information for a particular priority level, the UE shall omit all of the information at that priority level, except when the corresponding CSI report contains multiple ~~Part 2~~ CSI~~s~~ sub-reports with Part 2 each ~~of which~~ corresponding to a sub-configuration from a list of sub-configurations contained in the *CSI-ReportConfig* as described in Clause 5.2.1.1.  \*\*\* Unchanged text omitted \*\*\*  - For a Reporting Setting for which the *CSI-ReportConfig* contains a list of sub-configurations provided by the higher layer parameter [*csi-ReportSubConfigList*], for a corresponding CSI report which contains one or more CSI~~s~~ sub-reports, omission of Part 2 CSI is done at a sub-configuration level within the same priority level defined by Table 5.2.3-1 where a sub-configuration with an index, provided by [*csi-ReportSubConfigID*], with lower value has higher priority.  \*\*\* Unchanged text omitted \*\*\*  5.2.4 CSI reporting using PUCCH  \*\*\* Unchanged text omitted \*\*\*  If any of the CSI reports consist of two parts, the UE may omit a portion of Part 2 CSI. Omission of Part 2 CSI is according to the priority order shown in Table 5.2.3-1. For a Reporting Setting for which the *CSI-ReportConfig* contains a list of sub-configurations provided by the higher layer parameter [*csi-ReportSubConfigList*], for a given CSI report which contains one or more CSI~~s~~ sub-reports, omission of Part 2 CSI is defined in Clause 5.2.3. Part 2 CSI is omitted beginning with the lowest priority level until the Part 2 CSI code rate is less or equal to the one configured by higher layer parameter *maxCodeRate*.  \*\*\* Unchanged text omitted \*\*\*  ----------------------------------------------------------- End Text Proposal --------------------------------------------------------- |

## B. Objectives

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| The objectives of the work item are the following:   1. Specify SSB-less SCell operation for inter-band CA for FR1 and co-located cells, if found feasible by RAN4 study, where a UE measures SSB transmitted on PCell or another SCell for an SCell’s time/frequency synchronization (including downlink AGC), and L1/L3 measurements, including potential enhancement on SCell activation procedures if necessary [RAN4, RAN2] 2. Specify enhancement on cell DTX/DRX mechanism including the alignment of cell DTX/DRX and UE DRX in RRC\_CONNECTED mode, and inter-node information exchange on cell DTX/DRX [RAN2, RAN1, RAN3]  * Note: No change for SSB transmission due to cell DTX/DRX. * Note: The impact to IDLE/INACTIVE UEs due to the above enhancement should be avoided.  1. Specify the following techniques in spatial and power domains  * Specify necessary enhancements on CSI and beam management related procedures including measurement and report, and signaling to enable efficient adaptation of spatial elements (e.g. antenna ports, active transceiver chains) [RAN1, RAN2] * Specify necessary enhancements on CSI related procedures including measurement and report, and signaling to enable efficient adaptation of power offset values between PDSCH and CSI-RS [RAN1, RAN2] * Note: Above objectives are only for UE specific channels/signals * Note: Legacy UE CSI/CSI-RS capabilities applies when considering total number of CSI reports and requirements  1. Specify mechanism(s) to prevent legacy UEs camping on cells adopting the Rel-18 NES techniques, if necessary [RAN2] 2. Specify CHO procedure enhancement(s) in case source/target cell is in NES mode [RAN2] 3. Specify inter-node beam activation and enhancements on restricting paging in a limited area [RAN3]. 4. Specify the corresponding RRM/RF core requirements, if necessary, for the above features [RAN4] |