**3GPP TSG-RAN WG1 Meeting #117  R1-2405384**

**Fukuoka, Japan, May 20 – 24, 2024**

**Agenda Item: 8.1**

**Source: Moderator (Huawei)**

**Title: FLS#2 for maintenance of SD-PD adaptation R18 NES**

**Document for: Discussion and decision**

# Introduction

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

# Recommandation for online

[Tbd]

# Discussion

1. **Definition of CSI-RS EPRE for CQI calculation of a sub-configuration and the need of power scaling for *powerControlOffset* in Type 1 SD only**

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| **Conclusion (RAN1#96bis)**It is common understanding in RAN1 that:* The *powerControlOffset* (“Pc”) ratio is defined as  $10× log\_{10}\frac{P\_{PDSCH}}{P\_{CSIRS}}$dB
* Where
	+ - *PPDSCH* $P\_{PDSCH} $is the energy of total PDSCH ports multiplexed on one subcarrier of one OFDM symbol
		- *PCSIRS* $P\_{CSIRS} $is the energy of all CSI-RS ports multiplexed on one subcarrier of one OFDM symbol
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According to the above, there may be two related issues for Type 1 SD without PD operation for NES CSI framework.

Firstly, the CQI of a sub-configuration is calculated based on the power ratio between PDSCH EPRE and CSI-RS EPRE. It may need to calrify whether/which of all CSI-RS ports of a CSI-RS are used for calculation of the CSI-RS EPRE. Two interpreations are possible:

**Interpretation 1**: CSI-RS EPRE is based on *nrofPorts,* or based on, by definitnion, the SSB transmit power and *PowerControlOffsetSS* (which are effectively the same since no change in actural CSI-RS transmission and these parameters are constant across sub-configurations)

* + Supported: Samsung [1][2], Fujitsu [6][7], Ericsson [8]

**Interpretation 2**: CSI-RS EPRE is based on the port subset indicated by *portSubsetIndicator*

* + Supported: LGe [5],

Based on **Interpreation 2**, since both PCSIRS andPPDSCH scales as the ports are reduced, there is no further spec change needed regarding to UE assumption of EPRE between PDSCH and CSI-RS, though there may be a need to capture the interpretation 2 in specification.

Based on **Interpretation 1**, TPs are given for this clarification, as collected in Appendix.

Furthermore, as a second issue following **Interpretation 1**, due to unchanged PCSIRS in the above equation and PPDSCH which will also retain according to the configured *powerControlOffset*, the corresponding power over each antenna port is boosted when the number of antenna ports are adapted in Type 1 SD only, by the configured *portSubsetIndicator*, effectively resulting in joint operation of SD and PD adaptation.

To further address this, there are different possible approaches.

**Approach 1**: The UE assumption of EPRE ratio between PDSCH and CSI-RS for CQI calculation scales with the number of ports indicated by *portSubsetIndicator.*

* + Supported: Samsung [1][3], Fujitsu [6][7]

**Approach 2**: The *powerOffset* is mandatory present in a sub-configuration that contains *portSubsetIndicator*, even if the UE does not support a joint operation of Type 1 SD and PD.

* + Mentioned/supported: Ericsson [8]

**Approach 3**: No spec change is needed.

* + Supported: vivo

**###### Proposal 1**

**Discuss a proper interpretation and approach for addressing Issue 1.**

**###### Proposal 1-rev**

**Conclude that for Type 1 SD only, the CSI-RS ERPE assumption is not changed per the RRC parameter *portSubsetIndicator*.**

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| **Company** | **Supported Interpreation** | **Supported Approach/TP** |
| **LG Electronics** | Interpretation 2 | Approach 3. As we discussed in [5], our preferred approach is to keep the current specification, which means the EPRE ratio between PDSCH and CSI-RS remains the same as *powerControlOffset* for UE to derive CQI corresponding to a sub-configuration that is not configured with poweroffset. |
| Samsung | Interpretation 1 | Support Approach 1. Approach 2 does not work. If a UE supports only Type 1 SD (i.e., does not support PD or does not support a joint operation of Type 1 SD and PD), UE does not expect to be configured with a *powerOffset* in a sub-configuration. That means even if *powerOffset* is configured, UE will not look for it (which does not resolve the issue).  |
| **Fujitsu** | Interpretation 1 | For interpretation 2, it is not always true that PCSIRS scales along with reduced ports. For example, consider the adaptation patterns shown in Figure 1. Both pattern 2 and 3 have the same number of reduced ports, which is reduced from 32 ports to 16 ports. However, only the CSI-RS EPRE for pattern 3 scales proportional to port reduction, while the CSI-RS EPRE for pattern 2 remains the same value as pattern 1. Therefore, maintaining the current specification's assumption of a constant power offset across different sub-configurations implies that pattern 2 cannot be applied. Consequently, such constriant significantly limits the adaptable type 1 SD patterns and gNB implementation. **ゲーム画面のスクリーンショット  低い精度で自動的に生成された説明**Regarding approach 1 and approach 2, the former one is preferred as the it requires fewer specification changes. Approach 2, on the other hand, requires much more modifications, such as RRC parameters, UE features as well as corresponding description of CSI report quantity configurations in TS38.214 caulse 5.2.1.4.2. |
| **vivo** | Interpretation 1 | We don’t think there is problem in current spec since gNB and UE have aligned understanding on the PDSCH EPRE corresponding to the reported CSI. According to current spec, the total PDSCH EPRE is maintained between sub-configurations which is still spatial domain adaptation only. |
| **FL** | **Conclusion**Conclude that for Type 1 SD only, the CSI-RS ERPE assumption is not changed per the RRC parameter *portSubsetIndicator*.The above is agreed in the morning online session. Then the remaining question is when Type1 SD is applied, which approach is applied for CQI calcuation. In addition to the two approaches provided previously, there is also company considering that no spec change is workable, i.e. rely on gNB to take this into account when configuring the RRC parameter *powerContrlOffset*, which means that it is possible scenario that a UE may need to have boosted power over each PDSCH port when Type 1 SD only is configured. So Approach 3 is added. Again, for Approach 1, although the assumption of EPRE ratio between PDSCH and CSI-RS for CQI calculation scales as antenna ports adaptation, the intention is that the UE effectively does not perform power domain adaptation from implementation perspective, by maintaining the energy of each port unchanged. For Approach 2, supporting companies consider the presence of *powerOffset* can also achieve the same effect although the parameter is introduced for power domain adaptation. But that may require further clarification that by the parameters *powerOffset* and *powerContrlOffset*, the gNB shall ensure that no change on the energy of PDSCH ports, such that it is SD only adaptataion.Please continue to provide your preference/comments. |
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1. **CSI processing criteria for R18 NES UE capability**

A new UE capability as [*simultaneousCSI-SubReportsPerCC-r18*] was discussed in UE feature session of network energy savings in RAN#116bis and it was realized that the corresponding interpretation of this UE capability may be better to be captured as UE behaviour in core spec(s). Apple [4] proposed the following texts for a proper change to TS 38.214.

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| 5.2.1.6 CSI processing criteriaThe UE indicates the number of supported simultaneous CSI calculations $N\_{CPU}$ with parameter *simultaneousCSI-ReportsPerCC* or [*simultaneousCSI-SubReportsPerCC-r18*]in a component carrier, and *simultaneousCSI-ReportsAllCC* or *simultaneousCSI-SubReportsAllCC-r18* across all component carriers. If UE is configured with CSI report setting without sub-configuration in the component carrier, UE shall use parameter *simultaneousCSI-ReportsPerCC*; otherwise, UE shall use [*simultaneousCSI-SubReportsPerCC-r18*]. If UE is configured with CSI reporting setting without sub-configuration across all component carriers, UE shall use *simultaneousCSI-ReportsAllCC*; otherwise, UE shall use [*simultaneousCSI-SubReportsAllCC-r18*]. If a UE supports $N\_{CPU}$ simultaneous CSI calculations it is said to have $N\_{CPU}$ CSI processing units for processing CSI reports. If *L* CPUs are occupied for calculation of CSI reports in a given OFDM symbol, the UE has $N\_{CPU}-L$ unoccupied CPUs. If *N* CSI reports start occupying their respective CPUs on the same OFDM symbol on which $N\_{CPU}-L$ CPUs are unoccupied, where each CSI report $n=0, …, N-1$ corresponds to $O\_{CPU}^{(n)}$, the UE is not required to update the $N-M$ requested CSI reports with lowest priority (according to Clause 5.2.5), where $0\leq M\leq N $is the largest value such that $\sum\_{n=0}^{M-1}O\_{CPU}^{(n)}\leq N\_{CPU}-L $ holds.  |

**###### Proposal 2**

**Discuss the above TP for TS38.214.**

**###### Proposal 2-rev**

**Agree on the following TP for TS 38.214**

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| 5.2.1.6 CSI processing criteriaThe UE indicates the number of supported simultaneous CSI calculations $N\_{CPU}$ with parameter *simultaneousCSI-ReportsPerCC* or [*simultaneousCSI-SubReportsPerCC-r18*]in a component carrier, and *simultaneousCSI-ReportsAllCC* or [*simultaneousCSI-SubReportsAllCC-r18*] across all component carriers. If UE is configured with at least one CSI report setting with sub-configuration in a component carrier, UE shall use parameter [*simultaneousCSI-SubReportsPerCC-r18*] in the component carrier; otherwise, UE shall use *simultaneousCSI-ReportsPerCC* in the component carrier. If UE is configured with at least one CSI reporting setting with sub-configuration across all component carriers, UE shall use [*simultaneousCSI-SubReportsAllCC-r18*]; otherwise, UE shall use *simultaneousCSI-ReportsAllCC*. If a UE supports $N\_{CPU}$ simultaneous CSI calculations it is said to have $N\_{CPU}$ CSI processing units for processing CSI reports. If *L* CPUs are occupied for calculation of CSI reports in a given OFDM symbol, the UE has $N\_{CPU}-L$ unoccupied CPUs. If *N* CSI reports start occupying their respective CPUs on the same OFDM symbol on which $N\_{CPU}-L$ CPUs are unoccupied, where each CSI report $n=0, …, N-1$ corresponds to $O\_{CPU}^{(n)}$, the UE is not required to update the $N-M$ requested CSI reports with lowest priority (according to Clause 5.2.5), where $0\leq M\leq N $is the largest value such that $\sum\_{n=0}^{M-1}O\_{CPU}^{(n)}\leq N\_{CPU}-L $ holds.  |

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| **Company** | **Comments** |
| **LG Electronics** | OK |
| **ZTE, Sanechips** | OK with this proposal. |
| Samsung | We are generally fine with proposal and the following modification is suggested to make the wording clearer: “If UE is configured with at least one CSI report setting ~~without~~ with sub-configuration in a ~~the~~ component carrier, UE shall use parameter [*simultaneousCSI-SubReportsPerCC-r18*] *~~simultaneousCSI-ReportsPerCC~~* in the component carrier; otherwise, UE shall use ~~[~~*~~simultaneousCSI-SubReportsPerCC-r18~~*~~]~~ *simultaneousCSI-ReportsPerCC* in the component carrier. If UE is configured with at least one CSI reporting setting ~~without~~ with sub-configuration across all component carriers, UE shall use [*simultaneousCSI-SubReportsAllCC-r18*] *~~simultaneousCSI-ReportsAllCC~~*; otherwise, UE shall use ~~[~~*~~simultaneousCSI-SubReportsAllCC-r18~~*~~]~~ *simultaneousCSI-ReportsAllCC*.” |
| Fujitsu | Support. |
| vivo | One clarification on this:If UE reports simultaneousCSI-ReportsPerCC as 2 and simultaneousCSI-SubReportsAllCC-r18 as 8, does the following configuration is allowed, i.e. 4 simultaneous CSI reports where each with 2 sub-reports?In our understanding, simultaneousCSI-ReportsPerCC should be used regardless of whether sub-configuration is configured or not.  |

According to the following agreements, a draft CR is generated. Please comment if any further revisions are needed, or you want to co-source, or any new cases needs to be added.

Agreement

**Agree on the following TP for TS 38.214 in principle. Check if additional condition needs to be reflected.**

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| **5.2.1.6 CSI processing criteria**The UE indicates the number of supported simultaneous CSI calculations with parameter *simultaneousCSI-ReportsPerCC* or [*simultaneousCSI-SubReportsPerCC-r18*]in a component carrier, and *simultaneousCSI-ReportsAllCC* or [*simultaneousCSI-SubReportsAllCC-r18*] across all component carriers. If UE is configured with at least one CSI report setting with sub-configuration in a component carrier, UE shall use parameter [*simultaneousCSI-SubReportsPerCC-r18*] in the component carrier; otherwise, UE shall use *simultaneousCSI-ReportsPerCC* in the component carrier. If UE is configured with at least one CSI reporting setting with sub-configuration in any component carrier, UE shall use [*simultaneousCSI-SubReportsAllCC-r18*]; otherwise, UE shall use *simultaneousCSI-ReportsAllCC*. If a UE supports simultaneous CSI calculations it is said to have CSI processing units for processing CSI reports. If *L* CPUs are occupied for calculation of CSI reports in a given OFDM symbol, the UE has unoccupied CPUs. If *N* CSI reports start occupying their respective CPUs on the same OFDM symbol on which CPUs are unoccupied, where each CSI report corresponds to , the UE is not required to update the requested CSI reports with lowest priority (according to Clause 5.2.5), where is the largest value such that holds.  |

**###### Following up of Proposal 2-rev**

**The draftCR in R1-240xxx for TS 38.214 is endorsed. Final CR in xxx.**

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| **Company** | **Comments** |
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1. **(Closed) Semi-persistent CSI report under R18 CSI sub-report framework**

In current TS 38.214 as highlighted below, a UE is not expected to receive a DCI scrambled with SP-CSI-RNTI activating one SP CSI report with the same CSI-ReportConfigId as in a SP CSI report which is activated by a previous DCI.

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| TS 38.214For semi-persistent reporting on PUSCH, a set of trigger states are higher layer configured by *CSI-SemiPersistentOnPUSCH-TriggerStateList,* where the CSI request field in DCI scrambled with SP-CSI-RNTI activates one of the trigger states. For a reporting setting for which the *CSI-ReportConfig* contains a list of sub-configurations, provided by the higher layer parameter [*csi-ReportSubConfigList*], one or more trigger states can be configured with each indicating one or more of the sub-configurations. A UE is not expected to receive a DCI scrambled with SP-CSI-RNTI activating one semi-persistent CSI report with the same *CSI-ReportConfigId* as in a semi-persistent CSI report which is activated by a previously received DCI scrambled with SP-CSI-RNTI. |

However, for a CSI report configured with multiple sub-configurations, different trigger state can be configured with same CSI report but different sub-configurations. A DCI can indicate a trigger state and activate the corresponding CSI report and the sub-configurations. If gNB wants to change the activated sub-configurations for the CSI report, it should first deactivate the CSI report, and then indicate another trigger state to reactivate the CSI report with different sub-configurations. This process is quite cumbersome and will bring additional latency.

To address this,

**###### Proposal 3**

**Support that a Rel-18 NES-capable UE to receive a DCI activating an activated SP CSI report with different sub-configurations.**

* **If so, agree on the draft CR in [9] (*see TP for Issue#3 in Appendix*)?**

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| **Company** | **Comments** |
| **LG Electronics** | We are open to discuss this issue to make SP-CSI activation/deactivation more efficient for NES. |
| **ZTE, Sanechips** | Utilizing DCI to initiate an SP CSI report is designed for fast activation compared with MAC CE. In the legacy spec, UE doesn’t expect to receive DCI to activate the same and duplicated CSI report. However, for rel-18 NES, the same CSI report ID may correspond to different sub-configurations.If a Rel-18 NES-capable UE cannot receive DCI to re-activate an already active SP CSI report with alternate sub-configurations, the benefits such as efficiency and activation latency of DCI signaling, NES gain diminishes. Therefore, we support that a Rel-18 NES-capable UE to be capable of receiving DCI to re-activate an active SP CSI report with different sub-configurations and the draft CR in [9]. |
| Samsung | We understand the intention of the proposal. But re-activation of SP-CSI without the deactivation creates more follow-up issues. For example, What CSI-RS transmission occasions can be used for CSI derivation for the *CSI-ReportConfig*? For another example, when the PUSCH (on the corresponding resources) indicated by previous activation DCI stops transmission?To avoid complicated discussion, it seems simpler to keep the legacy restriction. |
| Fujitsu | Not support. This approach that improves the efficiency of DCI based SP-CSI report activation/deactivation appears to be an optimization rather than an essential correction.  |
| vivo | We understand the problem here. But we don’t support the TP that re-activation means de-activtion.  |

1. **(Closed) Spec alignments for configuration restrictions for Type 1 SD**

RAN1 agreed that the mixed codebook combination and *codebookconfig* and *codebookMode* shall only be applied to Type 1 SD. This has been (implicitly) captured in TS 38.331 (by *codebookSubConfig* which includes the mixed codebook combination, *codebookconfig* and *codebookMode*), while ZTE considers they should also be well captured in TS 38.214 for aligning with RAN2 specification and avoiding misunderstanding, thus a draft CR to TS 38.214 is provided in [10].

**###### Proposal 4**

**Agree on the draft CR in [10] (*see TP for Issue#4 in Appendix*)?**

**###### Proposal 4-rev**

**Agree on the following TP for editor alignment CR of TS 38.214**

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| 5.2.1.4.2 Report quantity configurations**<Unchanged parts are 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 which is configured with *portSubsetIndicator* 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 $p\_{0},p\_{1},...,p\_{Pm-1}$, where $p\_{0}$ is the MSB and $p\_{Pm-1}$ is the LSB, bit $p\_{i}$ corresponds to antenna port $3000+i$, and $Pm$ 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) which is configured with *portSubsetIndicator* can be configured with the higher layer parameter *codebookMode.***<Unchanged parts are omitted>** |

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| **Company** | **Comments** |
| **LG Electronics** | OK, but the TP can be slightly modified, e.g., as follows.- 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 which is configured with *portSubsetIndicator* can be configured with the higher layer parameter *codebookType* set to 'typeI-SinglePanel' or 'typeI-MultiPanel'. …..- 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) which is configured with *portSubsetIndicator* can be configured with the higher layer parameter *codebookMode.* |
| **ZTE, Sanechips** | 1. According to the agreement below, mixed codebook combination is introduced for Type 1 SD. However, TS 38.214 does not impose any restrictions, which means that mixed codebook combination can be applied to all CSI reports configured with sub-configurations. Therefore, we think they should be well captured in TS 38.214.

Therefore, we support the draft CR in [10].

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| AgreementFor 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.
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| TS 38.214If 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'.  |

1. Similar as issue#1, the configuration of codebookMode should only limited to Type 1 SD adaptation. However, in TS 38.214, the description is unclear and should be modified. According to current TS 38.214, the codebookMode should be configured in each sub-configuration if a sub-configuration is configured with an antenna port subset which is not aligned with the agreement.

Therefore, we support the draft CR in [10].

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| **Agreement****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 thatcodebookMode to be configured in each sub-configuration that contains *port-subsetIndicator*
 |
| TS 38.214- 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.* |

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| Samsung | We understand intention. If we want to make it crystal clear that “the sub-configuration” is configured with an antenna port subset, a simpler version can be considered as follows:“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.*” |
| Fujitsu | OK with the proposal. Either ZTE’s CR or LGE’s modification is fine. |

# Reference

1. R1-2404081 Remaining issues on network energy saving Samsung
2. R1-2404082 Correction on power assumption for type 1 spatial domain adaptation Samsung
3. R1-2404083 Correction on CSI-RS EPRE for type 1 spatial domain adaptation Samsung
4. R1-2404322 Draft CR for correction on CSI processing criteria for new NES capability signaling in TS38.214 Apple (UK) Limited
5. R1-2404886 Discussion on EPRE of CSI-RS and PDSCH for NES LG Electronics
6. R1-2405064 Remaining issue on NW energy saving techniques in spatial domain Fujitsu
7. R1-2405065 Correction on UE assumptions for CQI/PMI/RI calculation for type 1 spatial domain adaptation Fujitsu
8. R1-2405099 Discussion on power offset for spatial domain adaptation for Rel-18 NES Ericsson
9. R1-2405196 Draft CR for semi-persistent CSI report for Rel-18 NES ZTE, Sanechips
10. R1-2405197 Draft CR for CSI report configuration for Rel-18 NES ZTE, Sanechips

# Appendix

**TPs for Issue 1**

**Samsung**

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| **Reason for change:** The UE assumption of CSI-RS EPRE for CQI calculation of a sub-configuration is unclear when the port subset indicated by *portSubsetIndicator* for the sub-configuration.**Summary of change:** The UE assumption of CSI-RS EPRE for CQI calculation of a sub-configuration is based on *nrofPorts* when the port subset indicated by *portSubsetIndicator* for the sub-configuration.**Consequences if not approved:** Unclear UE assumption of CSI-RS EPRE for CQI calculation of a sub-configuration when the port subset indicated by *portSubsetIndicator* for the sub-configuration.**TP for TS 38.214 Clause 5.2.2.5.1 UE assumptions for CQI/PMI/RI calculation**<omitted texts>- For a UE configured with a *CSI-ReportConfig* that contains a list of sub-configurations provided by [*csi-ReportSubConfigList*],- if a sub-configuration indicates a CSI-RS antenna port subset using the higher layer bitmap parameter [*port-subsetIndicator*], as described in clause 5.2.1.4.2, for CQI calculation, 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*]. The UE should assume that PDSCH signals on antenna ports in the set [1000,…, 1000+ν-1] for ν layers would result in signals equivalent to corresponding symbols transmitted on antenna ports [3000, …, 3000+P-1] *T*, as given by$$\left[\begin{array}{c}y^{\left(3000\right)}\left(i\right)\\\cdots \\y^{\left(3000+P-1\right)}\left(i\right)\end{array}\right]=W\left(i\right)\left[\begin{array}{c}x^{\left(0\right)}\left(i\right)\\\cdots \\x^{\left(ν-1\right)}\left(i\right)\end{array}\right]$$where *P* corresponds to the number of bits with value 1 in the bitmap *[port-subsetIndicator]* and $x\left(i\right)=[x^{\left(0\right)}\left(i\right)…x^{\left(ν-1\right)}\left(i\right)]$*T* , and $W\left(i\right)$are as previously described in this Clause, and the corresponding PDSCH EPRE to CSI-RS EPRE is as previously defined in this Clause if the sub-configuration does not indicate a power offset *[powerOffset]*.- if a sub-configuration indicates a list of NZP CSI-RS resources, provided by [*nzp-CSI-RS-resourceList*] and does not indicate a power offset *[powerOffset]*, for CQI calculation for the sub-configuration the UE follows the procedure previously described in this Clause. - 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.*- if a sub-configuration indicates a CSI-RS antenna port subset using the higher layer bitmap parameter *port-subsetIndicator*,for CQI calculation for the sub-configuration, CSI-RS EPRE is based on *nrofPorts* of the corresponding CSI-RS resource.<omitted texts> |

**Samsung**

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| **TP for TS 38.214 Clause 5.2.2.5.1 UE assumptions for CQI/PMI/RI calculation****Reason for change:** The UE assumption of EPRE ratio between PDSCH and CSI-RS for CQI calculation is incorrect when the port subset indicated by *portSubsetIndicator* and *powerOffset* is not indicated for the sub-configuration.**Summary of change:** The UE assumption of EPRE ratio between PDSCH and CSI-RS for CQI calculation scales with the number of ports within indicated port subset when the port subset is indicated by *portSubsetIndicator* and *powerOffset* is not indicated for the sub-configuration.**Consequences if not approved:** Incorrect UE assumption of EPRE ratio between PDSCH and CSI-RS for CQI calculation when the port subset indicated by *portSubsetIndicator* and *powerOffset* is not indicated for the sub-configuration.<omitted texts>- For a UE configured with a *CSI-ReportConfig* that contains a list of sub-configurations provided by [*csi-ReportSubConfigList*],- if a sub-configuration indicates a CSI-RS antenna port subset using the higher layer bitmap parameter [*port-subsetIndicator*], as described in clause 5.2.1.4.2, for CQI calculation, 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*]. The UE should assume that PDSCH signals on antenna ports in the set [1000,…, 1000+ν-1] for ν layers would result in signals equivalent to corresponding symbols transmitted on antenna ports [3000, …, 3000+P-1] *T*, as given by$$\left[\begin{array}{c}y^{\left(3000\right)}\left(i\right)\\\cdots \\y^{\left(3000+P-1\right)}\left(i\right)\end{array}\right]=W\left(i\right)\left[\begin{array}{c}x^{\left(0\right)}\left(i\right)\\\cdots \\x^{\left(ν-1\right)}\left(i\right)\end{array}\right]$$where *P* corresponds to the number of bits with value 1 in the bitmap *[port-subsetIndicator]* and $x\left(i\right)=[x^{\left(0\right)}\left(i\right)…x^{\left(ν-1\right)}\left(i\right)]$*T* , and $W\left(i\right)$are as previously described in this Clause~~, and the corresponding PDSCH EPRE to CSI-RS EPRE is as previously defined in this Clause if the sub-configuration does not indicate a power offset~~ *~~[powerOffset]~~*.- if a sub-configuration indicates a list of NZP CSI-RS resources, provided by [*nzp-CSI-RS-resourceList*] and does not indicate a power offset *[powerOffset]*, for CQI calculation for the sub-configuration the UE follows the procedure previously described in this Clause.- if a sub-configuration indicates a CSI-RS antenna port subset using the higher layer bitmap parameter *port-subsetIndicator* and does not indicate a power offset *powerOffset*,for CQI calculation for the sub-configuration, 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 summation of *powerControlOffset* of the CSI-RS resource and $10log\_{10}(\frac{P}{P\_{0}})$, where *P* is the number of antenna ports corresponding to all bits with value of 1 in the *port-subsetIndicator*, *P*0 is the number of ports configured by *nrofPorts* of the CSI-RS resource.- 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 texts> |

**Fujitsu**

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| * **Reason for changes**

For type 1 SD adaptation where a sub-configuration indicates a CSI-RS antenna port subset without indicating a power offset, * the CSI-RS EPRE assumed for the sub-configuration is not clearly specified in current specification.
* the assumed ratio between PDSCH EPRE and NZP CSI-RS EPRE for the sub-configuration may not be the value configured *powerControlOffset* in the NZP CSI-RS resource configuration.
* **Summary of changes**

For type 1 SD adaptation where a sub-configuration indicates a CSI-RS antenna port subset without indicating a power offset, to capture the following* CSI-RS EPRE assumed for the sub-configuration is derived from the SSB transmit power and *powerControlOffsetSS* provided by CSI-RS resource configuration.
* The assumed ratio between PDSCH EPRE and NZP CSI-RS EPRE for the sub-configuration is the summation of the value provided by *powerControlOffset* and a scaling factor derived from the indicated antenna port subset.
* **Consequences if not approved**

Ambiguity on CSI-RS EPRE and inaccurate ratio between PDSCH EPRE and CSI-RS EPRE assumed for a sub-configuration that indicates a CSI-RS antenna port subset without indicating a power offset.---------------------------------------------------- Start of the TP for TS38.214-----------------------------------------5.2.2.5.1 UE assumptions for CQI/PMI/RI calculation<Unrelated part omitted>- For a UE configured with a *CSI-ReportConfig* that contains a list of sub-configurations provided by [*csi-ReportSubConfigList*],- if a sub-configuration indicates a CSI-RS antenna port subset using the higher layer bitmap parameter [*port-subsetIndicator*], as described in clause 5.2.1.4.2, for CQI calculation, 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*]. The UE should assume that PDSCH signals on antenna ports in the set [1000,…, 1000+ν-1] for ν layers would result in signals equivalent to corresponding symbols transmitted on antenna ports [3000, …, 3000+P-1] *T*, as given by$$\left[\begin{array}{c}y^{\left(3000\right)}\left(i\right)\\\cdots \\y^{\left(3000+P-1\right)}\left(i\right)\end{array}\right]=W\left(i\right)\left[\begin{array}{c}x^{\left(0\right)}\left(i\right)\\\cdots \\x^{\left(ν-1\right)}\left(i\right)\end{array}\right]$$where *P* corresponds to the number of bits with value 1 in the bitmap *[port-subsetIndicator]* and $x\left(i\right)=[x^{\left(0\right)}\left(i\right)…x^{\left(ν-1\right)}\left(i\right)]$*T* , and $W\left(i\right)$are as previously described in this Clause, and the corresponding PDSCH EPRE to CSI-RS EPRE is the summation of the ratio as previously defined in this Clause and $10∙log\_{10}\left(\frac{P}{P^{'}}\right)$ if the sub-configuration does not indicate a power offset *[powerOffset]*, where $P^{'}$ is the number of CSI-RS ports given in clause 5.2.2.3.1, and CSI-RS EPRE is given in clause 4.1.- if a sub-configuration indicates a list of NZP CSI-RS resources, provided by [*nzp-CSI-RS-resourceList*] and does not indicate a power offset *[powerOffset]*, for CQI calculation for the sub-configuration the UE follows the procedure previously described in this Clause. - 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 difference is 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*.<Unrelated part omitted>---------------------------------------------------- End of the TP for TS38.214------------------------------------------ |

**Ericsson**

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| <begin TP1 for 38.214, subclause 5.2.2.5.1>5.2.2.5.1 UE assumptions for CQI/PMI/RI calculationIf configured to report CQI index, in the CSI reference resource, or in each of the slot(s) associated with a CQI in the predicted CSI, as defined in Clause 5.2.1.4.2, the UE shall assume the following for the purpose of deriving the CQI index, and if also configured, for deriving PMI and RI:- The first 2 OFDM symbols are occupied by control signaling.- The number of PDSCH and DM-RS symbols is equal to 12.- The same bandwidth part subcarrier spacing configured as for the PDSCH reception- The bandwidth as configured for the corresponding CQI report.- The IAB-MT shall only assume the frequency resources as indicated by the DL TX power adjustment MAC CE, if indicated for the slot of the CSI reference resource by DL Tx Power Adjustment MAC CE as described in [10, TS 38.321].- The reference resource uses the CP length and subcarrier spacing configured for PDSCH reception - No resource elements used by primary or secondary synchronization signals or PBCH.- Redundancy Version 0.- The ratio of PDSCH EPRE to CSI-RS EPRE is as given in Clause 5.2.2.3.1.- In addition, the IAB-MT shall apply the provided DL TX power adjustment, if indicated for the slot of the CSI reference resource by DL Tx Power Adjustment MAC CE as described in [10, TS 38.321].- Assume no REs allocated for NZP CSI-RS and ZP CSI-RS.- Assume the same number of front-loaded DM-RS symbols as the maximum front-loaded symbols configured by the higher layer parameter *maxLength* in *DMRS-DownlinkConfig.* - Assume the same number of additional DM-RS symbols as the additional symbols configured by the higher layer parameter *dmrs-AdditionalPosition*.- Assume the PDSCH symbols are not containing DM-RS.- Assume PRB bundling size of 2 PRBs.- The PDSCH transmission scheme where the UE may assume that PDSCH transmission would be performed with up to 8 transmission layers as defined in Clause 7.3.1.4 of [4, TS 38.211]. For CQI calculation, the UE should assume that PDSCH signals on antenna ports in the set [1000,…, 1000+ν-1] for ν layers would result in signals equivalent to corresponding symbols transmitted on antenna ports [3000,…, 3000+*P*-1], as given by $\left[\begin{array}{c}y^{\left(3000\right)}(i)\\\cdots \\y^{\left(3000+P-1\right)}(i)\end{array}\right]=W(i)\left[\begin{array}{c}x^{\left(0\right)}(i)\\\cdots \\x^{\left(ν-1\right)}(i)\end{array}\right]$ where  is a vector of PDSCH symbols from the layer mapping defined in Clause 7.3.1.4 of [4, TS 38.211],  is the number of CSI-RS ports. If only one CSI-RS port is configured, *W(i)* is 1. If the higher layer parameter *reportQuantity* in *CSI-ReportConfig* for which the CQI is reported is set to either 'cri-RI-PMI-CQI' or 'cri-RI-LI-PMI-CQI', *W(i)* is the precoding matrix corresponding to the reported PMI applicable to *x(i)*. If the higher layer parameter *reportQuantity* in *CSI-ReportConfig* for which the CQI is reported is set to 'cri-RI-CQI', *W(i)* is the precoding matrix corresponding to the procedure described in Clause 5.2.1.4.2. If the higher layer parameter *reportQuantity* in *CSI-ReportConfig* for which the CQI is reported is set to 'cri-RI-i1-CQI', *W(i)* is the precoding matrix corresponding to the reported i1 according to the procedure described in Clause 5.2.1.4.2. The corresponding PDSCH signals transmitted on antenna ports [3000,…,3000 + *P* - 1] would have a ratio of EPRE to CSI-RS EPRE equal to the ratio given in Clause 5.2.2.3.1. - For a UE configured with a *CSI-ReportConfig* that contains a list of sub-configurations provided by [*csi-ReportSubConfigList*],- if a sub-configuration indicates a CSI-RS antenna port subset using the higher layer bitmap parameter [*port-subsetIndicator*], as described in clause 5.2.1.4.2, for CQI calculation, 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*]. The UE should assume that PDSCH signals on antenna ports in the set [1000,…, 1000+ν-1] for ν layers would result in signals equivalent to corresponding symbols transmitted on antenna ports [3000, …, 3000+P-1] *T*, as given by$$\left[\begin{array}{c}y^{\left(3000\right)}\left(i\right)\\\cdots \\y^{\left(3000+P-1\right)}\left(i\right)\end{array}\right]=W\left(i\right)\left[\begin{array}{c}x^{\left(0\right)}\left(i\right)\\\cdots \\x^{\left(ν-1\right)}\left(i\right)\end{array}\right]$$where *P* corresponds to the number of bits with value 1 in the bitmap *[port-subsetIndicator]* and $x\left(i\right)=[x^{\left(0\right)}\left(i\right)…x^{\left(ν-1\right)}\left(i\right)]$*T* , and $W\left(i\right)$are as previously described in this Clause~~, and the corresponding PDSCH EPRE to CSI-RS EPRE is as previously defined in this Clause if the sub-configuration does not indicate a power offset~~ *~~[powerOffset]~~*.- if a sub-configuration indicates a list of NZP CSI-RS resources, provided by [*nzp-CSI-RS-resourceList*] and does not indicate a power offset *[powerOffset]*, for CQI calculation for the sub-configuration the UE follows the procedure previously described in this Clause. - 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.*<end TP1 for 38.214, subclause 5.2.2.5.1> |

**TP for Issue 3**

**ZTE**

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| 5.2.1.5.2 Semi-persistent CSI/Semi-persistent CSI-RSFor semi-persistent reporting on PUSCH, a set of trigger states are higher layer configured by *CSI-SemiPersistentOnPUSCH-TriggerStateList,* where the CSI request field in DCI scrambled with SP-CSI-RNTI activates one of the trigger states. For a reporting setting for which the *CSI-ReportConfig* contains a list of sub-configurations, provided by the higher layer parameter [*csi-ReportSubConfigList*], one or more trigger states can be configured with each indicating one or more of the sub-configurations. For a *CSI-ReportConfig* not contains a list of sub-configurations, UE is not expected to receive a DCI scrambled with SP-CSI-RNTI activating one semi-persistent CSI report with the same *CSI-ReportConfigId* as in a semi-persistent CSI report which is activated by a previously received DCI scrambled with SP-CSI-RNTI. For a *CSI-ReportConfig* contains a list of sub-configurations, UE receives a DCI scrambled with SP-CSI-RNTI activating one semi-persistent CSI report with the same *CSI-ReportConfigId* but different sub-configurations as in a semi-persistent CSI report which is activated by a previously received DCI scrambled with SP-CSI-RNTI, the sub-configuration(s) activated by the previously received DCI are deactivated, while the sub-configuration(s) activated by the new DCI are activated. |

**TP for Issue 4**

**ZTE**

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| 5.2.1.4.2 Report quantity configurations**<Unchanged parts are 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 which configured with an antenna port subset 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 $p\_{0},p\_{1},...,p\_{Pm-1}$, where $p\_{0}$ is the MSB and $p\_{Pm-1}$ is the LSB, bit $p\_{i}$ corresponds to antenna port $3000+i$, and $Pm$ 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) which configured with an antenna port subset can be configured with the higher layer parameter *codebookMode.***<Unchanged parts are omitted>** |