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**Agenda item:** 8.1.1

**Source:** Samsung (Moderator)

**Title:** FL summary #0 for AI/ML in beam management

**Document for:** Discussion and Decision

# Introduction

This contribution summarised the remaining issues on AI/ML based beam management.

## (FL0) Question 0

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# Remaining issues for UE-side AI/ML model

## 2.1 CSI report for model inference

Proposals related to CSI report for model inference are summarized as follows.

**Huawei**

**Proposal 8: For the inference of UE-side model, some of the UE assumptions on the resource configuration in legacy spec needs to be revisited for the resource setting of Set A, including at least:**

* **UE does not need to perform rate matching around the RS configured in Set A in the inference CSI report.**
* **The resource type of Set A** **in the inference CSI report should be ignored, i.e.:**
  + **When a RS ID in Set A is configured in another resource configuration which is actually transmitted, it does not need to keep the same time domain behavior to Set A.**
  + **Set B does not need to keep the same time domain behavior to Set A configured in the same CSI report configuration.**

**Proposal 15: For the functionality alignment, regarding Option B Step 3, some of the UE assumptions on the resource configuration in legacy spec needs to be revisited for the resource setting of Set A/Set B, including at least:**

* **UE does not need to perform rate matching around the RS configured in Set A (resourcesForSetA-r19) and Set B (resourcesForChannelMeasurement) for applicability check.**
* **The resource type of Set A and Set B for applicability check should be ignored, i.e.:**
  + **When a RS ID in Set A/Set B is configured in another resource configuration which is actually transmitted, it does not need to keep the same time domain behavior to Set A/Set B.**

**Proposal 16: For functionality alignment, regarding Option A Step 4, some sub-IEs under CSI-reportConfig may configure multiple candidate values, so it needs to clarify the applicable value(s) reported by the applicability report.**

* **E.g., for A-CSI-RS, a maximum of 16 NZP CSI-RS resource sets can be configured in one nzp-CSI-RS-ResourceSetList referred by CSI-reportConfig.**

**Google**

**Proposal 5: Reuse the legacy collision handling rule of L1-RSRP report for the predicted CRI/SSBRI/RSRP report for collision handling between the predicted CRI/SSBRI/RSRP report and PUSCH/SRS/PUCCH.**

**Proposal 7: Support the UE to drop the inference results report if one of the followings happens:**

* **UE has not measured K consecutive transmission occasions for each of the set B beam within the same DRX active time**
  + **For BM-Case 1, K=1**
  + **For BM-Case 2, K is reported by the UE capability**
  + **The K transmission occasions includes the last transmission occasion before the CSI reference resource**
  + **The offset between every two consecutive transmissions is consistent**
* **The measured L1-RSRP for each of the set B beams is above a threshold**
  + **Send an LS to RAN4 to check the value for the threshold**

**Xiaomi**

**Proposal 3: Define the first or the last slot of the most recent occasion of the CSI-RS/SSB resource in Set B for measurement as the reference point of the transmission occasion to configure the time gap between two consecutive future time instances and between the reference time and the first future time instance for prediction.**

**Samsung**

**Proposal 1: Adopt the following TP for TS 38.214 Clause 5.2.1.4.3a for BM-Case2.**

**Reason for change:** The time domain relation between a reference time and the earliest time instance is unclear.

**Summary of change:** Clarify that the earliest time instance is after the reference time.

**Consequences if not approved:** gNB and UE may have different understanding on whether the earliest time instance is before or after the reference time.

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| **TP for TS 38.214 Clause 5.2.1.4.3a P-CRI, P-SSBRI, and P-L1-RSRP reporting**  <omitted texts>  For a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', the UE shall determine the reported P-CRI, P-SSBRI, and/or P-L1-RSRP based on:  - L1-RSRP measurements performed by the UE for the configured CSI-RS resources, or SS/PBCH block resources associated with the first Resource Setting given by *resourcesForChannelMeasurement*; and  - prediction is performed by the UE based on the L1-RSRP measurements associated with the first Resource Setting, for the configured CSI-RS resources, or SS/PBCH block resources associated with the second Resource Setting given by *resourcesForSetA-r19*.  For a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', if *nroftimeinstance-r19* is configured, the UE is configured with *TimeGap-r19* indicating a time gap between a reference time and the earliest time instance of *nroftimeinstance-r19* time instance(s) (defined in slot(s)), where the earliest time instance is after the reference time. If *nroftimeinstance-r19* is greater than 1, the same time gap is considered between two consecutive time instances. The UE considers the reference time to be the slot of the latest one of each CSI-RS/SSB resource, for channel measurement, respective latest CSI-RS/SSB transmission occasion no later than the corresponding CSI reference resource of the CSI report.  <omitted texts> |

**Proposal 2: Adopt the following TP for TS 38.214 Clause 5.2.1.4.3a for the description of ranking information for P-CRI or P-SSBRI.**

**Reason for change:** The description of ranking information for P-CRIs or P-SSBRIs is unclear.

**Summary of change:** Clarify that the ranking information is for P-CRIs or P-SSBRIs.

**Consequences if not approved:** UE cannot generate the ranking information.

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| **TP for TS 38.214 Clause 5.2.1.4.3a P-CRI, P-SSBRI, and P-L1-RSRP reporting**  <omitted texts>  For a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', if *nroftimeinstance-r19* is configured, the UE is configured with *TimeGap-r19* indicating a time gap between a reference time and the earliest time instance of *nroftimeinstance-r19* time instance(s) (defined in slot(s)). If *nroftimeinstance-r19* is greater than 1, the same time gap is considered between two consecutive time instances. The UE considers the reference time to be the slot of the latest one of each CSI-RS/SSB resource, for channel measurement, respective latest CSI-RS/SSB transmission occasion no later than the corresponding CSI reference resource of the CSI report.  For P-CRI or P-SSBRI reporting without P-L1-RSRP, the ranking information of the *nrofreportedpredictedrs-r19* P-CRIs or P-SSBRIs (per time instance, if *nroftimeinstance-r19* is configured) is conveyed by the order of the P-CRIs or P-SSBRIs reported in the CSI report, where the first reported P-CRI or P-SSBRI ranks first.  <omitted texts> |

**Ofinno**

**Proposal 1: On timing of inference result report for BM-Case2, down-select to endorse between the following alternatives on TP as:**

* **Alt 1: TP#1 for Option 1 in Annex A**
* **Alt 2: TP#2 for Option 2 in Annex B**

**[Option 1]** Timing of inference result report occurs before the earliest time instance of predicted time instances

**5.2.1.4.3a P-CRI, P-SSBRI, and P-L1-RSRP reporting**

For a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', the UE shall determine the reported P-CRI, P-SSBRI, and/or P-L1-RSRP based on:

- L1-RSRP measurements performed by the UE for the configured CSI-RS resources, or SS/PBCH block resources associated with the first Resource Setting given by *resourcesForChannelMeasurement*; and

- prediction is performed by the UE based on the L1-RSRP measurements associated with the first Resource Setting, for the configured CSI-RS resources, or SS/PBCH block resources associated with the second Resource Setting given by *resourcesForSetA-r19*.

For a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', if *nroftimeinstance-r19* is configured, the UE is configured with *TimeGap-r19* indicating a time gap between a reference time and the earliest time instance of *nroftimeinstance-r19* time instance(s) (defined in slot(s)). If *nroftimeinstance-r19* is greater than 1, the same time gap is considered between two consecutive time instances. The UE considers the reference time to be the slot of the latest one of each CSI-RS/SSB resource, for channel measurement, respective latest CSI-RS/SSB transmission occasion no later than the corresponding CSI reference resource of the CSI report. The UE expects a slot of the CSI report occurs earlier than or equal to the earliest time instance of *nroftimeinstance-r19* time instance(s) defined in slot(s)

**[Option 2]** Utilizing bit fields to include RSRP difference between predicted RSRP and measured RSRP

**5.2.1.4.3a P-CRI, P-SSBRI, and P-L1-RSRP reporting**

For a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', the UE shall determine the reported P-CRI, P-SSBRI, and/or P-L1-RSRP based on:

- L1-RSRP measurements performed by the UE for the configured CSI-RS resources, or SS/PBCH block resources associated with the first Resource Setting given by *resourcesForChannelMeasurement*; and

- prediction is performed by the UE based on the L1-RSRP measurements associated with the first Resource Setting, for the configured CSI-RS resources, or SS/PBCH block resources associated with the second Resource Setting given by *resourcesForSetA-r19*.

For a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', if *nroftimeinstance-r19* is configured, the UE is configured with *TimeGap-r19* indicating a time gap between a reference time and the earliest time instance of *nroftimeinstance-r19* time instance(s) (defined in slot(s)). If *nroftimeinstance-r19* is greater than 1, the same time gap is considered between two consecutive time instances. The UE considers the reference time to be the slot of the latest one of each CSI-RS/SSB resource, for channel measurement, respective latest CSI-RS/SSB transmission occasion no later than the corresponding CSI reference resource of the CSI report.

For P-CRI or P-SSBRI reporting without P-L1-RSRP, the ranking information of the *nrofreportedpredictedrs-r19* (per time instance, if *nroftimeinstance-r19* is configured)is conveyed by the order of theP-CRIs or P-SSBRIs reported in the CSI report, where the first reported P-CRI or P-SSBRI ranks first.

For P-L1-RSRP reporting,

- if P-L1-RSRP reporting occurs after *TimeGap-r19*, the UE shall use the difference value between L1-RSRP measurement and P-L1-RSRP value on each time instance of ‘p-cri-r19’ or ‘p-ssb-index-r19’ before the reporting.

**OPPO**

**Proposal 7: For inference with UE-side model, support UE to report (Opt 3) beam information on predicted Top K beam(s) and probability information of predicted Top K beam(s).**

**Panasonic**

**Proposal 7: Support mapping/association of beams within Set A and beams within Set B based on QCL relationship.**

**Proposal 12: Support to define that the predicted Top *K* beam(s) are the best *K* beam(s) based on the predicted RSRP** **or the probability of each beam in Set A to be the Top-1 beam**

* **The trade-off between the predicted RSRP values or the probability of the correctness of each beam in Set A to be the Top-1 beam are up to UE implementation.**

**Nokia**

**Proposal 1: For UE-sided BM Case-2 AP CSI report configuration, endorse the following text proposal to 38.214 Clause 5.2.1.4.1.**

**Reason for change**: To avoid unnecessary UE measurements logging, it was proposed that the NW can configure/indicate the UE with measurement RS set (Set B) to measure at multiple-time instances, where it is still to be clarified **how the UE is configured/indicated the number of measurements for Set B**.

**Summary of change**: Introduce a configuration to indicate the UE the number of measurements (N) for Set B in BM Case-2 AP CSI report scenario.

**Consequence if not approved:** If this issue is not addressed, there may be inefficiencies in UE operations due to unnecessary logging of measurements, potentially leading to increased resource consumption**.**

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| **5.2.1.4.1 Resource Setting configuration**  < Unchanged parts are omitted >  For aperiodic CSI, a UE may be configured with a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19' and when *nroftimeinstance-r19* is configured, or a UE is configured with a *CSI-ReportConfig* with *reportQuantity-r19* is set to 'rs-pai-r19', the UE is not expected to be configured with aperiodic CSI Resource Setting.  For a UE configured with a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' , 'p-ssb-index-RSRP-r19', or 'none-bm-r19', the UE is not expected to be configured with more than 64 NZP CSI-RS resources and/or SS/PBCH block resources in the second Resource Setting given by *resourcesForSetA*-r19.  For a UE configured with a CSI-ReportConfig with reportQuantity-r19 set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', the UE is not expected to measure the CSI-RS or SSB resources in the second Resource Setting given by resourcesForSetA-r19.  For aperiodic CSI with periodic or semi-persistent CSI Resource Setting, when the UE configured with a *CSI-ReportConfig* with reportQuantity-r19 set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and *nroftimeinstance-r19* is configured, the UE shall consider at least N most recent measurement occasions, no later than the CSI reference resource, of CSI-RS or SS/PBCH resources associated with the First Resource Setting, where the value N is given by the higher layer parameter *nroftimeinstanceSetB-r19.*  < Unchanged parts are omitted > |

**Proposal 2: For UE-sided BM Case-1 and 2, for AP CSI reporting for inference, endorse the following text proposal to 38.214 Clause 5.2.1.**

**Reason for change:** It is not clear how the trigger for AP CSI Report can carry the information for two Resource Set IDs.

**Summary of change:** Support in AP CSI triggering state of an additional indication with Resource Set ID for RS prediction for Set A selection. The associated *CSI-ReportConfig* corresponding to a trigger state in CSI-*AperiodicTriggerStateList* shall indicate, in addition to the Resource Set ID for channel measurement, a second Resource Set ID for RS prediction.

**Consequence if not approved:** If this issue is not addressed, the UE may face ambiguity in determining RS resources to be predicted.

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| **5.2.1 Channel state information framework**  < Unchanged parts are omitted >  For CQI, PMI, CRI, SSBRI, LI, RI, L1-RSRP, L1-SINR, CapabilityIndex, TDCP, L1-SRS-RSRP, L1-CLI-RSSI, SRS-RSRP-MRI, CLI-RSSI-MRI, CSI-PAI, P-CRI, P-SSBRI, P-L1-RSRP, RS-PAI, CJTC-Dd, CJTC-F, CJTC-Dd-F, CJTC-P, a UE is configured by higher layers with N≥1 *CSI-ReportConfig* Reporting Settings and/or X≥1 *ltm-CSI-ReportConfig* Reporting Settings, M≥1 *CSI-ResourceConfig* Resource Settings and/or Y≥1 *LTM-CSI-ResourceConfig* Resource Settings, and one or two list(s) of trigger states (given by the higher layer parameters *CSI-AperiodicTriggerStateList* and *CSI-SemiPersistentOnPUSCH-TriggerStateList*). Each trigger state in *CSI-AperiodicTriggerStateList* contains a list of associated *CSI-ReportConfigs* or one associated *LTM-CSI-ReportConfig* indicating the Resource Set IDs for channel and optionally for interference where a Resource Set for interference can only be present for a Report Setting given by a *CSI-ReportConfig* and a trigger state additionally contains one or more *reportSubConfigId* if the associated *CSI-ReportConfig* configured with a list of sub-configurations, as described in Clause 5.2.1.1. For P-CRI, P-SSBRI, and P-L1-RSRP, the associated *CSI-ReportConfig* corresponding to a trigger state in *CSI-AperiodicTriggerStateList* shall indicate, in addition to the Resource Set ID for channel measurement, a second Resource Set ID for RS prediction. Each trigger state in *CSI-SemiPersistentOnPUSCH-TriggerStateList* contains one associated *CSI-ReportConfig* or *LTM-CSI-ReportConfig*, and a trigger state additionally contain one or more *reportSubConfigId* if the associated CSI-ReportConfig is configured with a list of sub-configurations, as described in Clause 5.2.1.1.  < Unchanged parts are omitted > |

**Proposal 3: For UE-sided BM Case-1 and 2, for CSI-RS resources in Set A, endorse the following text proposal to 38.214 Clause 5.2.2.3.1.**

**Reason for change**: The same-periodicity requirement restricts the flexibility needed for AI/ML beam management, particularly when dealing with subsets of resource sets that require different transmission periodicities.

**Summary of change**: Allow different CSI-RS resources within a single set to have varied time-domain transmission behaviors when the resources belong to *resourcesForSetA-r19*, which are used for prediction.

**Consequence if not approved:** If this issue is not addressed, there could be ambiguity in determining the periodicity of CSI-RS resources in Set A.

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| **5.2.2.3.1 NZP CSI-RS** < Unchanged parts are omitted >  The UE can be configured with one or more NZP CSI-RS resource set configuration(s) as indicated by the higher layer parameters *CSI-ResourceConfig,* and *NZP-CSI-RS-ResourceSet.* Each NZP CSI-RS resource set consists of *K*≥1 NZP CSI-RS resource(s).  The following parameters for which the UE shall assume non-zero transmission power for CSI-RS resource are configured via the higher layer parameter *NZP-CSI-RS-Resource, CSI-ResourceConfig* and *NZP-CSI-RS-ResourceSet* for each CSI-RS resource configuration:  - *nzp-CSI-RS-ResourceId* determines CSI-RS resource configuration identity.  - *periodicityAndOffset* defines the CSI-RS periodicity and slot offset for periodic/semi-persistent CSI-RS. Except resources in *resourcesForSetA*-r19 used for predicted RS quantities reporting, a~~A~~ll the CSI-RS resources within one set are configured with the same periodicity, while the slot offset can be same or different for different CSI-RS resources.  - *resourceMapping* defines the number of ports, CDM-type, and OFDM symbol and subcarrier occupancy of the CSI-RS resource within a slot that are given in Clause 7.4.1.5 of [4, TS 38.211].  - *nrofPorts* in *resourceMapping* defines the number of CSI-RS ports, where the allowable values are given in Clause 7.4.1.5 of [4, TS 38.211].  - *density* in *resourceMapping* defines CSI-RS frequency density of each CSI-RS port per PRB, and CSI-RS PRB offset in case of the density value of 1/2, where the allowable values are given in Clause 7.4.1.5 of [4, TS 38.211]. For density 1/2, the odd/even PRB allocation indicated in *density* is with respect to the common resource block grid.  - *cdm-Type* in *resourceMapping* defines CDM values and pattern, where the allowable values are given in Clause 7.4.1.5 of [4, TS 38.211].  < Unchanged parts are omitted > |

**Proposal 5: For the configuration of the associated ID for AP-CSI-Report with AP-CSI-RS resource sets, support configuring multiple associated IDs each corresponding to a resource set in CSI-ResourceConfig.**

**LG**

**Proposal #6: Endorse the following TP for TS38.214.**

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| <S5.2.1.4.2>  ============================= unchanged parts are omitted ============================  If the UE is configured with a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', the following applies:  - when periodic Reporting Setting is configured for the *CSI-ReportConfig*, the UE expects that the *CSI-ReportConfig* is activated only if applicability of the corresponding *CSI-ReportConfig* is reported in *RRCReconfigurationComplete* and/or UAI reporting via *OtherConfig*.  If the UE is configured with a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', and with *nrofreportedpredictedrs-r19* and/or *nroftimeinstance-r19*, the following applies:  - the UE is not required to update measurements for more than 64 CSI-RS or SSB resources given by *resourcesForChannelMeasurement*,[ and is not expected to predict for more than 64 CSI-RS or SSB resources given by *resourcesForSetA-r19]*,  - the UE shall report one of the following in a single report:  - *nrofreportedpredictedrs-r19* different CRIs or SSBRIs of the second Resource Setting, if *nroftimeinstance-r19* is not configured and *reportQuantity-r19* is set to 'p-cri-r19' or 'p-ssb-index-r19',  - *nrofreportedpredictedrs-r19* different CRIs or SSBRIs of the second Resource Setting, with corresponding predicted L1-RSRP(s), if *nroftimeinstance-r19* is not configured and *reportQuantity-r19* set to 'p-cri-RSRP-r19' or 'p-ssb-index-RSRP-r19',  - *nrofreportedpredictedrs-r19* different CRIs or SSBRIs of the second Resource Setting for each of *nroftimeinstance-r19* time instance(s), if *nroftimeinstance-r19* is configured and *reportQuantity-r19* set to 'p-cri-r19' or 'p-ssb-index-r19',  - *nrofreportedpredictedrs-r19* different CRIs or SSBRIs of the second Resource Setting for each of *nroftimeinstance-r19* time instance(s), with corresponding predicted L1-RSRP(s), if *nroftimeinstance-r19* is configured and *reportQuantity-r19* set to 'p-cri-RSRP-r19' or 'p-ssb-index-RSRP-r19'.  If the UE is configured with a *CSI-ReportConfig* with *reportQuantity-r19* set to 'rs-pai-r19',  - the UE shall be configured with *inferenceReportConfigId-r19* to link another *CSI-ReportConfig* configured with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19',  - when semi-persistent Reporting Setting is configured for the *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', the UE is not expected to be configured with a periodic Reporting Setting for the *CSI-ReportConfig* with *reportQuantity-r19* set to 'rs-pai-r19'.  - when aperiodic Reporting Setting is configured for the *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', the UE is not expected to be configured with a periodic or semi-persistent Reporting Setting for the *CSI-ReportConfig* with *reportQuantity-r19* set to *reportQuantity-r19* set to 'rs-pai-r19'.  - the UE is not required to update measurements for more than 64 CSI-RS and/or SSB resources of the Resource Setting given by *resourcesForChannelMeasurement*.  ============================= unchanged parts are omitted ============================ |

**NEC**

**Proposal 1: For predicted RSRP, the Tx power is assumed based on the configured *powerControlOffsetSS* of the resource corresponding to the predicted beam in Set A.**

**Proposal 4: Adopt the following TP to TS 38.214 V19.0.0.**

**5.2.1.4.2 Report quantity configurations**

<Unchanged part omitted>

If the UE is configured with a *CSI-ReportConfig* with higher layer parameter *reportQuantity* set to 'cri-RSRP', 'cri-SINR', 'none', 'cri-RSRP- Index', 'cri-SINR- Index, 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', 'p-ssb-index-RSRP-r19', or ‘rs-pai-r19', and the *CSI-ReportConfig* is linked to a resource setting configured with the higher layer parameter *resourceType* set to 'aperiodic', then the UE is not expected to be configured with more than 16 CSI-RS resources in a CSI-RS resource set except the resource set configured by *resourcesForSetA* contained within the resource setting.

**CMCC**

**Proposal 3: For UE-sided model, regarding *CSI-ReportConfig* for aperiodic inference report,**

* + **support a resource setting (i.e., CSI-ResourceConfig) for Set A has only one aperiodic CSI-RS resource set**
  + **support a resource setting (i.e., *CSI-ResourceConfig*) for Set B has one or multiple aperiodic CSI-RS resource sets**
    - **the associated ID for Set A is applicable to all of the one or multiple aperiodic CSI-RS resource sets**

**Summary of change:**

Specify that NW can configure one aperiodic CSI-RS resource set for set A and one or multiple aperiodic CSI-RS resource sets in *CSI-ResourceConfig* for Set B, set A and set B share the same associated ID.

**Consequence if not approved:**

The number of aperiodic CSI-RS resource set for set A and application of associated ID on aperiodic CSI-RS resource sets in aperiodic inference report is ambiguous, which may cause the degradation on inference performance.

--------------------------- Start of Text Proposal for TS 38.214 -----------------------------

5.2.1.4.1 Resource Setting configuration

< Unchanged parts are omitted >

For aperiodic CSI, each trigger state configured using the higher layer parameter *CSI-AperiodicTriggerState* is associated with one or multiple *CSI-ReportConfig* where the *CSI-ReportConfig* not configured with *groupBasedBeamReporting-r17* or *groupBasedBeamReporting-r18* is linked to periodic, or semi-persistent, or aperiodic resource setting(s):

- When one Resource Setting is configured, the Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is for channel measurement for L1-RSRP or for channel and interference measurement for L1-SINR computation.

- When two Resource Settings are configured,

* if the *reportQuantity-r19* is set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', the first one Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is for channel measurement and the second one (given by higher layer parameter *resourcesForSetA-r19*) is for predicted RS quantities reporting. For the second Resource Setting, the number of CSI-RS Resource Sets configured is limited to S=1.
* otherwise, the first one Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is for channel measurement and the second one (given by either higher layer parameter *csi-IM-ResourcesForInterference* or higher layer parameter *nzp-CSI-RS-ResourcesForInterference*) is for interference measurement performed on CSI-IM or on NZP CSI-RS.

- When three Resource Settings are configured, the first Resource Setting (higher layer parameter *resourcesForChannelMeasurement*) is for channel measurement, the second one (given by higher layer parameter *csi-IM-ResourcesForInterference*) is for CSI-IM based interference measurement and the third one (given by higher layer parameter *nzp-CSI-RS-ResourcesForInterference*) is for NZP CSI-RS based interference measurement.

< Unchanged parts are omitted >

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

**Ericsson**

**Proposal 1. For UE-sided model, in CSI-ReportConfig for AP inference configuration, the resourceConfig for set A can only include a single resource set.**

**Proposal 3. For the UE-sided inference result report, support UE indicating in UCI if the inference result report is inaccurate/invalid by setting the CRI or SSB-RI to a fixed “dummy” value.**

**DOCOMO**

**Proposal 2. UE reports a CSI report for temporal domain beam management only if receiving at least the specified number of consecutive CSI-RS transmission occasions after the CSI report (re)configuration, serving cell activation, BWP change, or activation of SP-CSI.**

----------Text proposal for Section 5.2.2.5 TS 38.214----------

For a *CSI-ReportConfig* configured with *codebookType* set to 'typeII-Doppler-r18' or 'typeII-Doppler-PortSelection-r18', after the CSI report (re)configuration, serving cell activation, BWP change, or activation of SP-CSI, the UE reports a CSI report only if receiving at least one aperiodic or periodic or semipersistent consecutive CSI-RS transmission occasions for each CSI-RS resource in the corresponding CSI-RS Resource Set for channel measurement and one CSI-RS and/or CSI-IM resource transmission occasion for the CSI-RS and/or CSI-IM resource in the corresponding Resource Set for interference measurement no later than the CSI reference resource and within the same DRX Active Time, when DRX is configured, and drops the report otherwise. The value of is indicated by UE capability, as defined in clause 5.2.1.6.

For a *CSI-ReportConfig* configured with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', after the CSI report (re)configuration, serving cell activation, BWP change, or activation of SP-CSI, the UE reports a CSI report only if receiving at least one aperiodic or periodic or semipersistent consecutive CSI-RS transmission occasions for each CSI-RS resource in the corresponding CSI-RS Resource Set for channel measurement and one CSI-RS and/or CSI-IM resource transmission occasion for the CSI-RS and/or CSI-IM resource in the corresponding Resource Set for interference measurement no later than the CSI reference resource and within the same DRX Active Time, when DRX is configured, and drops the report otherwise. The value of is configured with the high layer signalling [XXX].

----------Text proposal ends---------------------------------------

**ASUSTeK**

**Proposal 1: Set A and set B configured in CSI-ReportConfig for inference should be configured in same BWP**

**Proposal 2: When generating an inference report with low confidence, RAN1 discuss how/whether UE inform gNB or drop the inference report**

**Text Proposal 1**

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| 5.2.1.4.1 Resource Setting configuration  <omitted>  For semi-persistent or periodic CSI, each *CSI-ReportConfig* is linked to periodic or semi-persistent Resource Setting(s):  - When one Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is configured, the Resource Setting is for channel measurement for L1-RSRP, for channel and interference measurement for L1-SINR, or for cross-link interference measurement for L1-SRS-RSRP or for cross-link interference measurement for L1-CLI-RSSI computation.  - When two Resource Settings are configured,  - if the *reportQuantity-r19* is set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', the first one Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is for channel measurement and the second one (given by higher layer parameter *resourcesForSetA-r19*) is for predicted RS quantities reporting.  - otherwise, if the *reportQuantity-r19* is not configured, the first Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is for channel measurement and the second Resource Setting (given by higher layer parameter *csi-IM-ResourcesForInterference*) is used for interference measurement performed on CSI-IM. For L1-SINR computation, the second Resource Setting (given by higher layer parameter *csi-IM-ResourcesForInterference* or higher layer parameter *nzp-CSI-RS-ResourceForInterference*) is used for interference measurement performed on CSI-IM or on NZP CSI-RS.  <omitted>  For a UE configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity-r19* set to 'none-bm-r19', the *CSI-ReportConfig* is linked to two periodic or two semi-persistent Resource Settings, and both the first Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) and the second Resource Setting (given by higher layer parameter *resourcesForSetA-r19*) are for channel measurement.  <omitted> |

**Reason for change:** Regarding structure for two resource settings for SP/P CSI, “otherwise” paragraph includes data collection case and legacy case (channel measurement + interference measurement) due to condition of “if” is not met. However, “data collection” part is indeed specified in other paragraph. It’s ambiguous that whether CSI-ReportConfig for data collection with two resource settings could be configured with *nzp-CSI-RS-ResourceForInterference* or not.

**Summary of change:** Add “if the reportQuantity-r19 is not configured” as a condition check under otherwise.

**Consequences if not approved:** It’s ambiguous that whether CSI-ReportConfig for data collection with two resource settings could be configured with *nzp-CSI-RS-ResourceForInterference* or not.

**Proposal 5: Adopts Text proposal 1 in TS 38.214 section 5.2.1.4.1.**

Based on the summary above, issues and corresponding proposals are provided as follows.

### **Issue 2.1.1# Relaxation of configuration restriction for Set A**

It is proposed by HW [1], Nokia [11] and NEC [12] that legacy configuration restriction for CSI Resource Settings shall be relaxed for Set A.

##### **Proposal. 2.1.1**

The following configuration restriction in TS38.214 is not applicable to CSI Resource Setting for Set A for CSI report for inference:

* When a UE is configured with multiple *CSI-ResourceConfigs* consisting the same NZP CSI-RS resource ID, the same time domain behavior shall be configured for the *CSI-ResourceConfigs*.
* All CSI Resource Settings linked to a CSI Report Setting shall have the same time domain behavior.
* All the CSI-RS resources within one set are configured with the same periodicity, while the slot offset can be same or different for different CSI-RS resources
* UE is not expected to be configured with more than 16 CSI-RS resources in a CSI-RS resource set contained within aperiodic resource setting.

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| Company | Y/N | Comments |
| FL |  | This is reasonable since RS in Set A is not actually transmitted and imposing the legacy configuration restriction is artificial and not needed. |
| Huawei, HiSilicon | Y |  |
| Xiaomi |  | ok |
| SPRD | Y |  |
| Ofinno | Y |  |
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### **Issue 2.1.2# Clarification on the indicated TCI state**

Google [2] proposed to ignore the indicated TCI state for Set A/B to maintain the consistency of associated ID.

##### **Proposal. 2.1.2**

Adopt the following TP for 38.214.

|  |
| --- |
| 5.2.1.4.1 Resource Setting configuration <omitted text>  For a UE configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity-r19* is set to 'none-bm-r19', 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', if the same Associated ID is configured to be associated with different resource sets, the UE may assume similar properties for the CSI-RS resources and/or SS/PBCH block resources among those different resource sets, irrespective of when the corresponding Resource Setting(s) is configured by higher layer signalling or released, and the UE shall ignore the indicated TCI state. |

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| Company | Y/N | Comments |
| FL |  | Please share your view on the proposal. |
| Huawei, HiSilicon |  | The TCI state is indicated individually for inference phase and training phase. They are naturally irrelevant. Not clear why UE shall ignore the indicated state? The “similar properties” means NW side additional condition which is not explicitly configured, and should be decoupled with TCI state which is explicitly configured. |
| Xiaomi |  | We are not clear why the TCI state is not needed. For example, set B is a subset of set A, the RS in the TCI state of the CSI-RS resource#1 is SSB#0, NW need to configure the TCI state of CSI-RS resource#1 for UE reception. But it doesn’t need to be dynamically updated, which is up to NW implementation. |
| SPRD | N | We believe that the TCI state is not entirely equivalent to the similar properties represented by the associated ID. The associated ID merely implicitly indicates whether the NW additional condition is similar, but it cannot precisely describe the TCI state characteristics of each RS. Therefore, the aforementioned modifications are not necessary. |
| Ofinno |  | Clarification is needed to ignore the indicated TCI state |
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### **Issue 2.1.3# The size of CSI resource setting for Set A**

Nokia [8] proposed a TP to introduce a new RRC parameter in AP CSI triggering state to indicate one resource set from the multiple resource sets in the CSI resource setting for Set A. Meanwhile, Ericsson [19] and CMCC [19] proposed to limit only one resource set in the CSI resource setting for Set A.

##### **Proposal. 2.1.3**

Down select one of the following on the CSI resource setting for Set A for CSI report for inference

* Alt-1. Only a single resource set can be configured for the CSI resource setting.
  + *Supported by: Ericsson, CMCC*
* Alt-2. Multiple resource sets can be configured for the CSI resource setting
  + Introduce a new RRC parameter in AP CSI trigger state to select one resource set from the multiple resource sets
  + *Supported by: Nokia*

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| Company | Alt-1/Alt-2 | Comments |
| FL |  | A down selection is suggested from the two directions. Please share your view on the proposal and which alternative is preferred. |
| Huawei, HiSilicon | Alt-2 | There seems no need to limit the number of resources sets for A-CSI report. |
| Xiaomi | Alt-1 | Regarding the main bullet, suggest the update below  Down select one of the following on the CSI resource setting for Set A for aperiodic CSI report for inference for UE-side model |
| SPRD |  | We support the main bullet of Alt-2. There is no need to limit the number of configurable AP resource sets. However, there is a need for further discussion on the method of selecting multiple AP resource sets. |
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### **Issue 2.1.4# Clarification on the reference time for BM-Case2**

Some companies [5,7] proposed to clarify the clarification of reference time and the associated future time instance for BM-Case2. In particular, Xiaomi proposed to clarify the exact slot of reference time which can be either the first one or the last one. However, in the existing TS38.214, this issue is resolved by the description of “the latest one of each CSI-RS/SSB resource”. Also, Samsung proposed to clarify that the earliest time instance is after the reference time.

##### **Proposal. 2.1.4**

Adopt the following TP for TS 38.214 Clause 5.2.1.4.3a for BM-Case2.

**Reason for change:** The time domain relation between a reference time and the earliest time instance is unclear.

**Summary of change:** Clarify that the earliest time instance is after the reference time.

**Consequences if not approved:** gNB and UE may have different understanding on whether the earliest time instance is before or after the reference time.

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| **TP for TS 38.214 Clause 5.2.1.4.3a P-CRI, P-SSBRI, and P-L1-RSRP reporting**  <omitted texts>  For a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', the UE shall determine the reported P-CRI, P-SSBRI, and/or P-L1-RSRP based on:  - L1-RSRP measurements performed by the UE for the configured CSI-RS resources, or SS/PBCH block resources associated with the first Resource Setting given by *resourcesForChannelMeasurement*; and  - prediction is performed by the UE based on the L1-RSRP measurements associated with the first Resource Setting, for the configured CSI-RS resources, or SS/PBCH block resources associated with the second Resource Setting given by *resourcesForSetA-r19*.  For a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', if *nroftimeinstance-r19* is configured, the UE is configured with *TimeGap-r19* indicating a time gap between a reference time and the earliest time instance of *nroftimeinstance-r19* time instance(s) (defined in slot(s)), where the earliest time instance is after the reference time. If *nroftimeinstance-r19* is greater than 1, the same time gap is considered between two consecutive time instances. The UE considers the reference time to be the slot of the latest one of each CSI-RS/SSB resource, for channel measurement, respective latest CSI-RS/SSB transmission occasion no later than the corresponding CSI reference resource of the CSI report.  <omitted texts> |

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| Company | Y/N | Comments |
| FL |  | Please share your view on the TP. |
| Huawei, HiSilicon | Y |  |
| Xiaomi |  | Support |
| SPRD | N | We are unsure as to why the earliest time instance occurs earlier than the reference time. |
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### **Issue 2.1.5# The condition for dropping CSI report for inference**

In [2], it is proposed by Google that the dropping of CSI report for inference is based on at least one of 1) the reception of RS occasions for channel measurement and 2) measured L1-RSRP is above a given threshold. Also, similar proposed is provided by DOCOMO [22] considering the first condition.

##### **Proposal. 2.1.5**

Support the following on the reporting condition of CSI reporting for inference

* For BM-Case1, UE transmit a CSI report for inference only if receiving at least one transmission occasion for each of the RS resources in Set B no later than the corresponding CSI reference resource within the same DRX active time.
* For BM-Case2, UE transmit a CSI report for inference only if receiving at least K latest consecutive transmission occasion for each of the RS resources in Set B no later than the corresponding CSI reference resource within the same DRX active time, where K is indicated by UE capability.

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| Company | Y/N | Comments |
| FL |  | The proposal is formulated for BM-Case1 and BM-Case2 respectively based on legacy principle considering the reception of RS occasions for channel measurement. |
| Huawei, HiSilicon |  | BM-Case 1 – need to clarify what is the difference from legacy BM?  BM-Case 2 – OK. Same rule as R18 CSI prediction. |
| Xiaomi |  | First, please clarify that it is for UE-side model in the main bullet.  Support the following on the reporting condition of CSI reporting for inference for UE-side model  Second, for BM Case 2, we suggest the update below:   * For BM-Case2, UE transmit a CSI report for inference only if receiving at least K latest consecutive transmission occasion for each of the RS resources in Set B no later than the corresponding CSI reference resource within the same DRX active time, where K is configured by NW based on UE capability. |
| SPRD |  | Agree with HW. For Case 2, we can compare it to non-AI CSI prediction. However, for the traditional BM, there are currently no corresponding restrictions. |
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### **Issue 2.1.6# PDSCH rate matching**

In [1], it is proposed by HW that RS in Set A shall not be considered for PDSCH rate matching.

##### **Proposal. 2.1.6**

For virtual resource blocks mapping of PDSCH in TS38.211, rate matching of the resource elements in the corresponding physical resource blocks are not performed around the NZP CSI-RS in Set A for CSI report for inference.

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| Company | Y/N | Comments |
| FL |  | This is reasonable since it was agreed that RS in Set A is not measured hence it is not necessary to be transmitted by NW. In the existing 38.211, same rate matching rule is used for both NZP CSI-RS for mobility and AP NZP CSI-RS, which can be extended to the RS in Set A. |
| Huawei, HiSilicon |  | OK with the direction. But two comments:  1) Other than Set A configured for inference, the RS exempted for rate matching should also include Set A and Set B configured in Step 3 for applicability check Option B.  2) One additional thing: how to handle the case if the same RS is also configured in another resource set which is actually transmitted? |
| SPRD | Y |  |
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### **Issue 2.1.7# Collision handling of CSI report for inference and other signals/channels**

In [2], it is proposed by Google that the collision handling rule for CSI report for inference and other signals/channels shall follows the same rule for legacy beam report.

##### **Proposal. 2.1.7**

The collision handling rule for legacy beam report and other signals/channels is reuse for CSI report for inference.

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| Company | Y/N | Comments |
| FL |  | This is a natural by extending the collision handling rule for legacy beam report to the CSI report for inference.  If agreeable, can Google or other companies help to provide a full Draft TP for further check? |
| Huawei, HiSilicon |  | Not clear the intention: does it mean CSI priority for predicted CSI report? |
| Xiaomi |  | Support |
| SPRD |  | We believe that currently no new values have been introduced for the priority of AI-based CSI reports. This already indicates that the reports based on AI and those not based on AI have the same priority. Therefore, no further explanation is necessary. |
| Ofinno |  | Similar view with SPRD |
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### **Issue 2.1.8# Clarification on the ranking information**

Samsung [7] proposed an editorial TP to clarify the ranking information.

##### **Proposal. 2.1.8**

Adopt the following TP for the clarification of ranking information.

**Reason for change:** The description of ranking information for P-CRIs or P-SSBRIs is unclear.

**Summary of change:** Clarify that the ranking information is for P-CRIs or P-SSBRIs.

**Consequences if not approved:** UE cannot generate the ranking information.

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| --- |
| **TP for TS 38.214 Clause 5.2.1.4.3a P-CRI, P-SSBRI, and P-L1-RSRP reporting**  <omitted texts>  For a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', if *nroftimeinstance-r19* is configured, the UE is configured with *TimeGap-r19* indicating a time gap between a reference time and the earliest time instance of *nroftimeinstance-r19* time instance(s) (defined in slot(s)). If *nroftimeinstance-r19* is greater than 1, the same time gap is considered between two consecutive time instances. The UE considers the reference time to be the slot of the latest one of each CSI-RS/SSB resource, for channel measurement, respective latest CSI-RS/SSB transmission occasion no later than the corresponding CSI reference resource of the CSI report.  For P-CRI or P-SSBRI reporting without P-L1-RSRP, the ranking information of the *nrofreportedpredictedrs-r19* P-CRIs or P-SSBRIs (per time instance, if *nroftimeinstance-r19* is configured) is conveyed by the order of the P-CRIs or P-SSBRIs reported in the CSI report, where the first reported P-CRI or P-SSBRI ranks first.  <omitted texts> |

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| Company | Y/N | Comments |
| FL |  | Please share your view on the TP. |
| Huawei, HiSilicon | Y |  |
| Xiaomi |  | Ok |
| SPRD | Y |  |
| Ofinno | Y |  |
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### **Issue 2.1.9# Clarification on the timing of CSI report for inference**

Ofinno [8] proposed to clarify the timing of CSI report for inference.

##### **Proposal. 2.1.9**

Adopt the following TP for the clarification of ranking information.

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| **5.2.1.4.3a P-CRI, P-SSBRI, and P-L1-RSRP reporting**  For a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', the UE shall determine the reported P-CRI, P-SSBRI, and/or P-L1-RSRP based on:  - L1-RSRP measurements performed by the UE for the configured CSI-RS resources, or SS/PBCH block resources associated with the first Resource Setting given by *resourcesForChannelMeasurement*; and  - prediction is performed by the UE based on the L1-RSRP measurements associated with the first Resource Setting, for the configured CSI-RS resources, or SS/PBCH block resources associated with the second Resource Setting given by *resourcesForSetA-r19*.  For a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', if *nroftimeinstance-r19* is configured, the UE is configured with *TimeGap-r19* indicating a time gap between a reference time and the earliest time instance of *nroftimeinstance-r19* time instance(s) (defined in slot(s)). If *nroftimeinstance-r19* is greater than 1, the same time gap is considered between two consecutive time instances. The UE considers the reference time to be the slot of the latest one of each CSI-RS/SSB resource, for channel measurement, respective latest CSI-RS/SSB transmission occasion no later than the corresponding CSI reference resource of the CSI report. The UE expects a slot of the CSI report occurs earlier than or equal to the earliest time instance of *nroftimeinstance-r19* time instance(s) defined in slot(s). |

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| Company | Y/N | Comments |
| FL |  | Two options of TP are provided where the second one will introduce a new report quantity which is too late in CR phase. Therefore, the first option is proposed. |
| Huawei, HiSilicon | N | No need to have restriction to gNB scheduling. If the overhead is the concern, a better way is that UE discards the predicted time instance earlier than the CSI report. |
| Xiaomi |  | We think it can be controlled by NW. |
| SPRD | N | It is up to NW’s implementation. |
| Ofinno | Y | The purpose of Option 1 is not to restrict gNB scheduling, but to set a minimum baseline rule that the UE report should not be later than the earliest time instance. This cannot be left purely to implementation, because otherwise the gNB has no guarantee that UE reports are aligned with the configured time instances. |
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### **Issue 2.1.10# Measurement configuration of SP/P resource for AP CSI report for inference of BM-Case2**

Nokia [8] proposed to introduce a new RRC parameter to indicate UE the number of measurements (N) for Set B in BM Case-2 AP CSI report scenario.

##### **Proposal. 2.1.10**

Adopt the following TP for UE-sided BM Case-2 AP CSI report configuration.

**Reason for change**: To avoid unnecessary UE measurements logging, it was proposed that the NW can configure/indicate the UE with measurement RS set (Set B) to measure at multiple-time instances, where it is still to be clarified how the UE is configured/indicated the number of measurements for Set B.

**Summary of change**: Introduce a configuration to indicate the UE the number of measurements (N) for Set B in BM Case-2 AP CSI report scenario.

**Consequence if not approved:** If this issue is not addressed, there may be inefficiencies in UE operations due to unnecessary logging of measurements, potentially leading to increased resource consumption**.**

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| **5.2.1.4.1 Resource Setting configuration**  < Unchanged parts are omitted >  For aperiodic CSI, a UE may be configured with a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19' and when *nroftimeinstance-r19* is configured, or a UE is configured with a *CSI-ReportConfig* with *reportQuantity-r19* is set to 'rs-pai-r19', the UE is not expected to be configured with aperiodic CSI Resource Setting.  For a UE configured with a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' , 'p-ssb-index-RSRP-r19', or 'none-bm-r19', the UE is not expected to be configured with more than 64 NZP CSI-RS resources and/or SS/PBCH block resources in the second Resource Setting given by *resourcesForSetA*-r19.  For a UE configured with a CSI-ReportConfig with reportQuantity-r19 set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', the UE is not expected to measure the CSI-RS or SSB resources in the second Resource Setting given by resourcesForSetA-r19.  For aperiodic CSI with periodic or semi-persistent CSI Resource Setting, when the UE configured with a *CSI-ReportConfig* with reportQuantity-r19 set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and *nroftimeinstance-r19* is configured, the UE shall consider at least N most recent measurement occasions, no later than the CSI reference resource, of CSI-RS or SS/PBCH resources associated with the First Resource Setting, where the value N is given by the higher layer parameter *nroftimeinstanceSetB-r19.*  < Unchanged parts are omitted > |

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| Company | Y/N | Comments |
| FL |  | This is an extension of UE behavior for legacy beam reporting, i.e., only the latest measurement is considered for CSI derivation when *timeRestrictionForChannelMeasurements* in *CSI-ReportConfig* is set to "*Configured*". Please share your view on the TP. |
| Huawei, HiSilicon | N | The measurement logging buffer is up to UE implementation. |
| SPRD | N | It should be UE’s implementation. |
| Ofinno | N | It depends on UE implementation/capability. |
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### **Issue 2.1.11# DL Tx Power assumption for predicted L1-RSRP**

NEC [8] proposed to use configured *powerControlOffsetSS* of the resource in Set A as UE assumption for the derivation of predicted L1-RSRP.

##### **Proposal. 2.1.11**

For the derivation of predicted L1-RSRP, UE assumes the ratio of EPRE of NZP CSI-RS in Set A to SS/PBCH block EPRE based on the *powerControlOffsetSS* for the corresponding NZP CSI-RS resource.

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| Company | Y/N | Comments |
| FL |  | This is similar to the CSI derivation for PMI, RI, CQI where UE assumes the ratio of PDSCH EPRE to NZP CSI-RS EPRE based on *powerControlOffset*. |
| Huawei, HiSilicon |  | No clear on the motivation: Set A in inference set is a virtual set, and its RS power is not applicable. As long as the model is trained by assuming a corresponding *powerControlOffsetSS* of Set B, it would derive the correct L1-RSRP in Set A? |
| Xiaomi |  | Does it mean the consistency on additional condition of transmission power? |
| SPRD |  | Further explanation is needed on how to derive it. |
| Ofinno |  | Similar understanding with Huawei. Need some clarification (Is it for the ground truth for Set A?) |
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### **Others**

Ericsson [19] and ASUSTeK [23] proposed to discuss the UE behavior when inference report is of low accuracy. However, there is no associated definition from RAN1 perspective which is difficult to discuss the associated UE behavior at this stage.

OPPO [9] and Panasonic [10] proposed to introduce option 3 for inference result report. However, it is too late to introduce new report quantity in CR phase.

HW [1] proposed the clarify the content of applicable report when the corresponding CSI report configuration is with multiple parameters. LG [12] proposed a TP for the clarification of CSI reporting behavior associated with applicable reporting. However, it is understood that there is no RAN1 impact on the applicable report.

ASUSTeK [23] proposed that Set A and set B should be within the BWP. However, this can be handled by NW implementation. Also, ASUSTeK proposed a TP related to the UE assumption on the purpose of configured resource set. However, the specification is clear without the change.

|  |  |
| --- | --- |
| Company | Comments |
| FL | Please share your comments and suggestions, if any. |
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## 2.2 CSI report for performance monitoring

**Huawei**

**Proposal 10: For monitoring of UE-side model, consider the following cases as invalid linked pair of inference report and** **monitoring RS, and preclude from the calculation of RS-PAI:**

* **Case 1: Failed generation of measurement on monitoring RS due to unsatisfied CPU occupation condition for the monitoring CSI processing.**
* **Case 2: Failed generation of the linked inference result due to unsatisfied PU occupation condition or timeline condition for the inference CSI processing.**

**Proposal 11: For monitoring of UE-side model, considering the case of A-CSI report for inference and P/SP-CSI-RS for monitoring, duplicated mapping from more than one monitoring RS to one prediction result should be precluded when determining the conditions of linked pairs.**

**Table 2 Text proposal for the mapping between Set A and monitoring resource set**

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| --- |
| **5.2.1.4.3b RS-PAI Reporting**  ……  - at least one of the *nrofBestBeamforMonitoring-r19* identified CSI-RS resources, or SS/PBCH Block resources is mapped one of the *nrofreportedpredictedrs-r19* reported P-CRI(s) or P-SSBRI(s), of the linked report of the first CSI Reporting Setting, wherein  - the mapping between CSI-RS resources, or SS/PBCH Block resources of Resource Set for channel measurement of the second CSI Reporting Setting and CSI-RS resources, or SS/PBCH Block resources of Resource Set given by *resourcesForSetA-r19* of the first CSI Reporting Setting is provided by the higher layer parameter *RSMappingtoSetA* in the second CSI Reporting Setting, if the number of resources in Resource Set for channel measurement of the second CSI Reporting Setting is smaller than the number of resources in Resource Set given by *resourcesForSetA-r19*.  - otherwise, the n-th resource of Resource Set for channel measurement of the second CSI Reporting Setting is mapped to the n-th resource of Resource Set given by *resourcesForSetA-r19*, where n is the index of the CSI-RS resource, or SS/PBCH Block resource of the corresponding Resource Set with ascending order. |

**Proposal 12: Consider the text proposal in Table 2 for the mapping between Set A and monitoring resource set in 38.214.**

**Google**

**Proposal 6: Reuse the legacy collision handling rule of L1-RSRP report for the RS-PAI report for collision handling between the RS-PAI report and PUSCH/SRS/PUCCH.**

**Proposal 8: Support the UE to drop the monitoring results report if one of the followings happens:**

* **UE has not measured K consecutive transmission occasions for each of the set B beam within the same DRX active time**
  + **For BM-Case 1, K=1**
  + **For BM-Case 2, K is reported by the UE capability**
  + **The K transmission occasions includes the last transmission occasion before the CSI reference resource**
  + **The offset between every two consecutive transmissions is consistent**
* **The measured L1-RSRP for each of the set B beams is above a threshold**
  + **Send an LS to RAN4 to check the value for the threshold**
* **UE has not measured K transmission occasions for each of the DL-RS for monitoring within the same DRX active time**
  + **For BM-Case 1, K=1**
  + **For BM-Case 2, the K transmission occasions are based on the prediction window configuration**
* **The measured L1-RSRP for each of the DL-RS for monitoring is above a threshold**
  + **Send an LS to RAN4 to check the value for the threshold**

**CATT**

**Summary of change:**

We propose to correct the mapping description ‌for cases where the monitoring set size is equal to that of Set A and where it is smaller than that of Set A.

**Consequence if not approved:**

The mapping provided by RRC applies both when the size of the monitoring set is the same as that of Set A and when it is smaller than that of Set A, which is not aligned with the agreement.

**Proposal 4: For the performance monitoring of UE-sided model, adopt the following TP:**

---------------------------------------------------------Start of TP for TS38.214-----------------------------------------------

5.2.1.4.3b RS-PAI Reporting

<Unrelated part omitted>

- determine the best *nrofBestBeamforMonitoring-r19* CSI-RS resources, or SS/PBCH Block resources based on L1-RSRP(s) measured CSI-RS resources, or SS/PBCH Block resources of the corresponding Resource Set;

- check a condition :

<Unrelated part omitted>

- at least one of the *nrofBestBeamforMonitoring-r19* identified CSI-RS resources, or SS/PBCH Block resources is mapped one of the *nrofreportedpredictedrs-r19* reported P-CRI(s) or P-SSBRI(s), of the linked report of the first CSI Reporting Setting, wherein the mapping between CSI-RS resources, or SS/PBCH Block resources of Resource Set for channel measurement of the second CSI Reporting Setting and CSI-RS resources, or SS/PBCH Block resources of Resource Set given by *resourcesForSetA-r19* of the first CSI Reporting Setting is provided by the higher layer parameter *RSMappingtoSetA* in the second CSI Reporting Setting if the number of resources in the Resource Set for channel measurement of the second CSI Reporting Setting is smaller than the number of resources in the Resource Set given by resourcesForSetA-r19 of the first CSI Reporting Setting, or the n-th resource in the Resource Set for channel measurement of the second CSI Reporting Setting is mapped to the n-th resource in the Resource Set given by resourcesForSetA-r19 of the first CSI Reporting Setting if the number resources in the Resource Set for channel measurement of the second CSI Reporting Setting is the same as that of the Resource Set given by resourcesForSetA-r19 of the first CSI Reporting Setting;

<Unrelated part omitted>

---------------------------------------------------------- End of TP for TS38.214-----------------------------------------------

**vivo**

**Proposal 1: For performance monitoring, for UE-side model, support one of the following options for BAI reporting at initial monitoring procedure.**

* **Option 1: Restrict UE from submitting reports until the configured number of monitoring instances is achieved**
* **Option 2: Prohibit the network from deactivating inference configurations prior to a reference point, and the reference point can be FFS.**
* **Option 3: Reporting the number of accurate predictions and actual monitoring instances in the monitoring report.**
* **Option 4: Reporting the number of accurate predictions and accurate ratio in the monitoring report, which accurate ratio can be defined as the number of accurate predictions divided by actual monitoring instances**

**Nokia**

**Proposal 4: For UE-sided BM Case-2 AP CSI report configuration, endorse the following text proposal to 38.214 Clause 5.2.1.4.3b.**

**Reason for change**: To ensure that monitoring results are properly calculated at the UE, it is to clarify that for AP Report for inference, the number of transmission occasions triggered by AP report for monitoring should be limited to M = 1. With this limitation, AP monitoring of AP inference is not useful, though there may be alternative ways to address this issue.

**Summary of change**: For AP Report for inference, limit the number of transmission occasions triggered by AP report for monitoring to M = 1.

**Consequence if not approved:** If this change is not implemented, there could inconsistencies in determining monitoring results at the UE.

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| 5.2.1.4.3b RS-PAI Reporting  When the UE is configured with a first CSI Reporting Setting for reporting P-CRI, P-SSBRI, and/or P-L1-RSRP, based on a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', and a second CSI Reporting Setting for reporting RS-PAI, based on a *CSI-ReportConfig* with *reportQuantity-r19* set to 'rs-pai-r19', and the second Reporting Setting is linked to the first Reporting Setting by *inferenceReportConfigId-r19*, the reporting of RS-PAI corresponding to the second CSI Reporting Setting shall consider the following:  < Unchanged parts are omitted >  - determine RS-PAI as the total count of accurate reference signals prediction instance(s), and the UE shall report RS-PAI for the second Reporting Setting, with a -bit field (*M* is given by *nroftransmissionOccasion-r19*).  When both the first and the second CSI Reporting Settings are aperiodic, the UE is not expected to configure with a value larger than 1 for *nroftransmissionOccasion-r19.*  < Unchanged parts are omitted > |

**Xiaomi**

**Proposal 2: Define the first or the last slot of the CSI-RS/SSB resources for monitoring as the reference point of the transmission occasion to determine the linked inference report.**

**Samsung**

**Proposal 3: Adopt the following TP for TS 38.214 Clause 5.2.1.4.3b** **for CSI reporting for RS-PAI.**

**Reason for change:** The condition associated with CSI reporting for RS-PAI is unclear.

**Summary of change:** Clarify that the *timeinstanceformonitoring-r19*-thtime instance is used in case of BM-Case2 for condition check. Adding the description on resource mapping methods depending on the size of the set for monitoring is smaller than or the same as the size of Set A.

**Consequences if not approved:** gNB and UE may have different understanding on the condition associated with CSI reporting for RS-PAI.

|  |
| --- |
| **TP for TS 38.214 Clause 5.2.1.4.3b RS-PAI Reporting**  <omitted texts>  5.2.1.4.3b RS-PAI Reporting  When the UE is configured with a first CSI Reporting Setting for reporting P-CRI, P-SSBRI, and/or P-L1-RSRP, based on a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', and a second CSI Reporting Setting for reporting RS-PAI, based on a *CSI-ReportConfig* with *reportQuantity-r19* set to 'rs-pai-r19', and the second Reporting Setting is linked to the first Reporting Setting by *inferenceReportConfigId-r19*, the reporting of RS-PAI corresponding to the second CSI Reporting Setting shall consider the following:   * for each of the *nroftransmissionOccasion-r19* latest transmission occasion(s), where the latest transmission occasion of *nroftransmissionOccasion-r19* latest transmission occasion(s), and the latest report of the first CSI Reporting Setting considered for linking, are no later than the CSI reference resource corresponding to the CSI report of the second CSI Reporting setting, the UE shall:   - perform L1-RSRP measurements for the configured CSI-RS resources, or SS/PBCH Block resources, associated with the transmission occasion of the corresponding Resource Set for channel measurement of the second CSI Reporting Setting;  - determine the best *nrofBestBeamforMonitoring-r19* CSI-RS resources, or SS/PBCH Block resources based on L1-RSRP(s) measured CSI-RS resources, or SS/PBCH Block resources of the corresponding Resource Set;  - check a condition :  - for the transmission occasion of the second CSI Reporting Setting, there is a linked report of the first CSI Reporting Setting. When *nroftimeinstance-r19* is not configured in the first Reporting Setting, the linking is determined if CSI reference resource of a report of the first CSI Reporting Setting has a minimal slot offset, no larger than 64 slots, from the slot of the transmission occasion of the corresponding Resource Set for channel measurement of the second CSI Reporting Setting. When *nroftimeinstance-r19* is configured in the first Reporting Setting, *timeinstanceformonitoring-r19* configured in the second CSI Reporting Setting indicates the *timeinstanceformonitoring-r19*-thtime instance among *nroftimeinstance-r19* time instance(s), and the linking is determined if the slot corresponding to the time instance indicated by *timeinstanceformonitoring-r19* of a report of the first CSI Reporting Setting has a minimal slot offset, no larger than 64 slots, from the slot of the transmission occasion of the corresponding Resource Set for channel measurement of the second CSI Reporting Setting;  - at least one of the *nrofBestBeamforMonitoring-r19* identified CSI-RS resources, or SS/PBCH Block resources is mapped one of the *nrofreportedpredictedrs-r19* reported P-CRI(s) or P-SSBRI(s), for the *timeinstanceformonitoring-r19*-thtime instance if *nroftimeinstance-r19* is configured, of the linked report of the first CSI Reporting Setting, wherein the mapping between CSI-RS resources, or SS/PBCH Block resources of Resource Set for channel measurement of the second CSI Reporting Setting and CSI-RS resources, or SS/PBCH Block resources of Resource Set given by *resourcesForSetA-r19* of the first CSI Reporting Setting is provided by the higher layer parameter *RSMappingtoSetA* in the second CSI Reporting Setting if the size of the resource set for the second CSI Reporting Setting is smaller than the size of the resource set given by *resourcesForSetA-r19*; or the n-th entry of resource in the resource set for the second CSI Reporting Setting is mapped the n-th entry of resource in the resource set given by *resourcesForSetA-r19* if the size of the resource set for the second CSI Reporting Setting is the same as the size of the resource set given by *resourcesForSetA-r19*;  - if this condition is met, the transmission occasion is counted as an accurate reference signal prediction instance; otherwise, it is not counted as an accurate reference signal prediction instance;   * determine RS-PAI as the total count of accurate reference signals prediction instance(s), and the UE shall report RS-PAI for the second Reporting Setting, with a -bit field (*M* is given by *nroftransmissionOccasion-r19*).   <omitted texts> |

**Proposal 4: Adopt the following TP for TS 38.214 Clause 5.2.2.5 for adding the condition of reporting RS-PAI.**

**Reason for change:** The condition of reporting RS-PAI is unclear.

**Summary of change:** Adding the condition of reporting RS-PAI.

**Consequences if not approved:** gNB and UE may have different understanding on the condition of reporting RS-PAI.

|  |
| --- |
| **TP for TS 38.214 Clause 5.2.2.5 CSI reference resource definition**  <omitted texts>  For a *CSI-ReportConfig* configured with the higher layer parameter *reportQuantity* set to 'etypeII-Doppler-r19', 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 aperiodic or 𝐾𝑝 consecutive periodic/semi-persistent CSI-RS transmission occasion(s) for each of the CSI-RS resources in each CSI-RS resource group in the corresponding CSI-RS resource set for channel measurement and at least one CSI-RS and/or CSI-IM resource transmission occasion for each of the CSI-RS and/or CSI-IM resources in the corresponding resource set for interference measurement no later than the CSI reference resource and within the same DRX active time, when DRX is configured, and drops the report otherwise. The value of 𝐾𝑝∈{1,2,4} is indicated by UE capability, as defined in clause 5.2.1.6.  For a *CSI-ReportConfig* configured with the higher layer parameter *reportQuantity* set to 'rs-pai-r19', 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 *nroftransmissionOccasion-r19* latest transmission occasion(s) for each of the CSI-RS resource or SS/PBCH Block resource in the corresponding resource set for channel measurement no later than the CSI reference resource and within the same DRX Active Time, when DRX is configured, and drops the report otherwise.  <omitted texts> |

**Ofinno**

**Proposal 3**: **Endorse TP#4 in Annex D for performance monitoring.**

**5.2.1.4.3b RS-PAI Reporting**

When the UE is configured with a first CSI Reporting Setting for reporting P-CRI, P-SSBRI, and/or P-L1-RSRP, based on a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', and a second CSI Reporting Setting for reporting RS-PAI, based on a *CSI-ReportConfig* with *reportQuantity-r19* set to 'rs-pai-r19', and the second CSI Reporting Setting is linked to the first CSI Reporting Setting by *inferenceReportConfigId-r19*, the reporting of RS-PAI corresponding to the second CSI Reporting Setting shall consider the following:

- for each of the *nroftransmissionOccasion-r19* latest transmission occasion(s), where the latest transmission occasion of *nroftransmissionOccasion-r19* latest transmission occasion(s), and the latest report of the first CSI Reporting Setting considered for linking, are no later than the CSI reference resource corresponding to the CSI report of the second CSI Reporting setting, the UE shall:

- perform L1-RSRP measurements for the configured CSI-RS resources, or SS/PBCH Block resources, associated with the transmission occasion of the corresponding Resource Set for channel measurement of the second CSI Reporting Setting;

- determine the best *nrofBestBeamforMonitoring-r19* CSI-RS resources, or SS/PBCH Block resources based on L1-RSRP(s) measured CSI-RS resources, or SS/PBCH Block resources of the corresponding Resource Set;

- check a condition :

- for the transmission occasion of the second CSI Reporting Setting, there is a linked report of the first CSI Reporting Setting. When *nroftimeinstance-r19* is not configured in the first Reporting Setting, the linking is determined if CSI reference resource of a report of the first CSI Reporting Setting has a minimal slot offset, no larger than 64 slots, from the slot of the transmission occasion of the corresponding Resource Set for channel measurement of the second CSI Reporting Setting. When *nroftimeinstance-r19* is configured in the first Reporting Setting, *timeinstanceformonitoring-r19* configured in the second CSI Reporting Setting indicates the *timeinstanceformonitoring-r19*-thtime instance among *nroftimeinstance-r19* time instance(s), and the linking is determined if the slot corresponding to the time instance indicated by *timeinstanceformonitoring-r19* of a report of the first CSI Reporting Setting has a minimal slot offset, no larger than 64 slots, from the slot of the transmission occasion of the corresponding Resource Set for channel measurement of the second CSI Reporting Setting; and

- if the Resource Set for channel measurement of the second CSI Reporting Setting is a full set of Resource Set given by *resourcesForSetA-r19* of the first CSI Reporting Setting, at least one of the *nrofBestBeamforMonitoring-r19* identified CSI-RS resources, or SS/PBCH Block resources is mapped one of the *nrofreportedpredictedrs-r19* reported P-CRI(s) or P-SSBRI(s), of the linked report of the first CSI Reporting Setting, wherein the mapping between CSI-RS resources, or SS/PBCH Block resources of Resource Set for channel measurement of the second CSI Reporting Setting and CSI-RS resources, or SS/PBCH Block resources of Resource Set given by *resourcesForSetA-r19* of the first CSI Reporting Setting is provided by the higher layer parameter *RSMappingtoSetA* in the second CSI Reporting Setting; or

- if the Resource Set for channel measurement of the second CSI Reporting Setting is a subset of Resource Set given by *resourcesForSetA-r19* of the first CSI Reporting Setting, a ranking of the best *nrofBestBeamforMonitoring-r19* identified CSI-RS resources is the same as a ranking, of the best *nrofBestBeamforMonitoring-r19* CSI-RS resources, based on the subset of Resource Set given by *resourcesForSetA-r19* of the first CSI Reporting Setting.

- if this condition is met, the transmission occasion is counted as an accurate reference signal prediction instance; otherwise, it is not counted as an accurate reference signal prediction instance;

- determine RS-PAI as the total count of accurate reference signals prediction instance(s), and the UE shall report RS-PAI for the second Reporting Setting, with a -bit field (*M* is given by *nroftransmissionOccasion-r19*).

**OPPO**

**Proposal 9: For Type 1 Option 2 performance monitoring, support the probability of model output (Alt.4) as performance metric.**

**Proposal 11: For performance monitoring, study the event-based LCM with performance metric of beam prediction accuracy (Alt.1) and probability (Alt.4).**

**Proposal 12: For performance monitoring with UE-side model, support Type 2 (indication/request/report from UE to gNB) performance monitoring.**

**Panasonic**

**Proposal 11: For UE-sided model monitoring Type 1 option 2, regarding the type of resource for the set for monitoring, support aperiodic CSI-RS when *N* =1 is configured.**

**Proposal 13: Group-based beam reporting can be enhanced to support performance monitoring for NW-sided model.**

**LG**

**Proposal #1: Support aperiodic CSI-RS for the type of resource for performance monitoring.**

**Proposal #2: For Type 1 - Option 2 performance monitoring, the performance metric should be counted from N-th latest transmission occasion of the CSI-RS/SSB resources for monitoring no later than the CSI reference resource corresponding to the CSI report for monitoring, regardless of whether the N latest transmission occasions of the CSI-RS/SSB resources for monitoring have linked inference report instance or not.**

* **UE further reports the number of invalid transmission occasion of resources for monitoring without linked inference report, so that NW can be aware of the number of valid linkages and have better understanding on reported metric.**

**Proposal #7: Endorse the following TP for TS38.214.**

|  |
| --- |
| <S5.2.1.4.3b>  5.2.1.4.3b RS-PAI Reporting  When the UE is configured with a first CSI Reporting Setting for reporting P-CRI, P-SSBRI, and/or P-L1-RSRP, based on a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', and a second CSI Reporting Setting for reporting RS-PAI, based on a *CSI-ReportConfig* with *reportQuantity-r19* set to 'rs-pai-r19', and the second Reporting Setting is linked to the first Reporting Setting by *inferenceReportConfigId-r19*, the reporting of RS-PAI corresponding to the second CSI Reporting Setting shall consider the following:  - for each of the *nroftransmissionOccasion-r19* latest transmission occasion(s), where the latest transmission occasion of *nroftransmissionOccasion-r19* latest transmission occasion(s), and the latest report of the first CSI Reporting Setting considered for linking, are no later than the CSI reference resource corresponding to the CSI report of the second CSI Reporting setting, the UE shall:  - perform L1-RSRP measurements for the configured CSI-RS resources, or SS/PBCH Block resources, associated with the transmission occasion of the corresponding Resource Set for channel measurement of the second CSI Reporting Setting;  - determine ~~the best~~ *nrofBestBeamforMonitoring-r19* CSI-RS resources, or SS/PBCH Block resources based on largest L1-RSRP~~(s)~~ value(s) of measured CSI-RS resources, or SS/PBCH Block resources of the corresponding Resource Set;  - check a condition :  - for the transmission occasion of the second CSI Reporting Setting, there is a linked report of the first CSI Reporting Setting. When *nroftimeinstance-r19* is not configured in the first Reporting Setting, the linking is determined if CSI reference resource of a report of the first CSI Reporting Setting has a minimal slot offset, no larger than 64 slots, from the slot of the transmission occasion of the corresponding Resource Set for channel measurement of the second CSI Reporting Setting. When *nroftimeinstance-r19* is configured in the first Reporting Setting, *timeinstanceformonitoring-r19* configured in the second CSI Reporting Setting indicates the *timeinstanceformonitoring-r19*-thtime instance among *nroftimeinstance-r19* time instance(s), and the linking is determined if the slot corresponding to the time instance indicated by *timeinstanceformonitoring-r19* of a report of the first CSI Reporting Setting has a minimal slot offset, no larger than 64 slots, from the slot of the transmission occasion of the corresponding Resource Set for channel measurement of the second CSI Reporting Setting;  - at least one of the *nrofBestBeamforMonitoring-r19* identified CSI-RS resources, or SS/PBCH Block resources is mapped one of the *nrofreportedpredictedrs-r19* reported P-CRI(s) or P-SSBRI(s), of the linked report of the first CSI Reporting Setting, wherein the mapping between CSI-RS resources, or SS/PBCH Block resources of Resource Set for channel measurement of the second CSI Reporting Setting and CSI-RS resources, or SS/PBCH Block resources of Resource Set given by *resourcesForSetA-r19* of the first CSI Reporting Setting is provided by the higher layer parameter *RSMappingtoSetA* in the second CSI Reporting Setting;  - if this condition is met, the transmission occasion is counted as an accurate reference signal prediction instance; otherwise, it is not counted as an accurate reference signal prediction instance;  - determine RS-PAI as the total count of accurate reference signals prediction instance(s), and the UE shall report RS-PAI for the second Reporting Setting, with a -bit field (*M* is given by *nroftransmissionOccasion-r19*).  ============================= unchanged parts are omitted ============================ |

**Apple**

**Proposal 3-1: take the following procedure for performance monitoring for AI/ML BM:**

* **NW configures/signals the UE with and**
* **Identify the CSI reference resource timing for performance monitoring**
* **For** 
  + **Identify up to measurement instances with the performance monitoring no later than**
  + **Identify up to prediction instances with the BM inference CSI report**
  + **Populate the beam prediction accuracy matrix according to agreed rule.**
* **Accumulate beam prediction accuracy: .**
* **UE reports the accumulated beam prediction accuracy.**

**Proposal 3-2: Discuss whether semi-static TDD DL/UL patterns are considered in determining the minimal slot offset.**

**NEC**

**Proposal 2: If inference report associated with monitoring report is stopped during monitoring, the following monitoring behaviors needs to be considered for the monitoring report:**

* **The monitoring report is stopped.**
* **UE calculate (and report) performance metric based on the monitoring instances already collected.**

**Fujitsu**

**Proposal 1: The following TP on the resource mapping between the resource set for monitoring and Set A is proposed to be captured into TS 38.214.**

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| 5.2.1.4.3b RS-PAI Reporting  When the UE is configured with a first CSI Reporting Setting for reporting P-CRI, P-SSBRI, and/or P-L1-RSRP, based on a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', and a second CSI Reporting Setting for reporting RS-PAI, based on a *CSI-ReportConfig* with *reportQuantity-r19* set to 'rs-pai-r19', and the second Reporting Setting is linked to the first Reporting Setting by *inferenceReportConfigId-r19*, the reporting of RS-PAI corresponding to the second CSI Reporting Setting shall consider the following:  - for each of the *nroftransmissionOccasion-r19* latest transmission occasion(s), where the latest transmission occasion of *nroftransmissionOccasion-r19* latest transmission occasion(s), and the latest report of the first CSI Reporting Setting considered for linking, are no later than the CSI reference resource corresponding to the CSI report of the second CSI Reporting setting, the UE shall:  - perform L1-RSRP measurements for the configured CSI-RS resources, or SS/PBCH Block resources, associated with the transmission occasion of the corresponding Resource Set for channel measurement of the second CSI Reporting Setting;  - determine the best *nrofBestBeamforMonitoring-r19* CSI-RS resources, or SS/PBCH Block resources based on L1-RSRP(s) measured CSI-RS resources, or SS/PBCH Block resources of the corresponding Resource Set;  - check a condition :  - for the transmission occasion of the second CSI Reporting Setting, there is a linked report of the first CSI Reporting Setting. When *nroftimeinstance-r19* is not configured in the first Reporting Setting, the linking is determined if CSI reference resource of a report of the first CSI Reporting Setting has a minimal slot offset, no larger than 64 slots, from the slot of the transmission occasion of the corresponding Resource Set for channel measurement of the second CSI Reporting Setting. When *nroftimeinstance-r19* is configured in the first Reporting Setting, *timeinstanceformonitoring-r19* configured in the second CSI Reporting Setting indicates the *timeinstanceformonitoring-r19*-thtime instance among *nroftimeinstance-r19* time instance(s), and the linking is determined if the slot corresponding to the time instance indicated by *timeinstanceformonitoring-r19* of a report of the first CSI Reporting Setting has a minimal slot offset, no larger than 64 slots, from the slot of the transmission occasion of the corresponding Resource Set for channel measurement of the second CSI Reporting Setting;  - at least one of the *nrofBestBeamforMonitoring-r19* identified CSI-RS resources, or SS/PBCH Block resources is mapped one of the *nrofreportedpredictedrs-r19* reported P-CRI(s) or P-SSBRI(s), of the linked report of the first CSI Reporting Setting, wherein the mapping between CSI-RS resources, or SS/PBCH Block resources of Resource Set for channel measurement of the second CSI Reporting Setting and CSI-RS resources, or SS/PBCH Block resources of Resource Set given by *resourcesForSetA-r19* of the first CSI Reporting Setting is provided by the higher layer parameter *RSMappingtoSetA* in the second CSI Reporting Setting; when the size of the resource set for channel measurement of the second CSI Reporting Setting is the same as the size of the Resource Set given by *resourcesForSetA-r19* of the first CSI Reporting Setting, the n-th resource in the resource set for channel measurement of the second CSI Reporting Setting is linked to the n-th resource in the Resource Set given by *resourcesForSetA-r19* of the first CSI Reporting Setting; when the size of the resource set for channel measurement of the second CSI Reporting Setting is smaller than the size of the Resource Set given by *resourcesForSetA-r19* of the first CSI Reporting Setting, *RSMappingtoSetA* is a X-bit bitmap, and the y-th nonzero bit of the bitmap corresponds to the y-th entry of the resource set for channel measurement of the second CSI Reporting Setting, where X is the size of the Resource Set given by *resourcesForSetA-r19* of the first CSI Reporting Setting;  - if this condition is met, the transmission occasion is counted as an accurate reference signal prediction instance; otherwise, it is not counted as an accurate reference signal prediction instance;  - determine RS-PAI as the total count of accurate reference signals prediction instance(s), and the UE shall report RS-PAI for the second Reporting Setting, with a -bit field (*M* is given by *nroftransmissionOccasion-r19*). |

**Sharp**

**Proposal 8: Adopt the following TP#8 in TS 38.214 to clarify that, if two inference reports have CSI reference resources with the identical minimal slot offset to one transmission occasion for monitoring, the UE shall randomly select one linked inference report for the evaluation of whether a transmission occasion is an accurate reference signal prediction instance.**

**Reason for change:** A case arises when two inference reports have CSI reference resources with same minimal offset to the monitoring transmission occasion (i.e., one prior to the monitoring transmission occasion and one after the monitoring transmission occasion). The ambiguity occurs that whether both two inference reports may be used for the evaluation of whether a transmission occasion is an accurate reference signal prediction instance.

**Summary of change:** Add relevant description to clarify that one inference report is used for evaluation of whether a transmission occasion is an accurate reference signal prediction instance

**Consequences if not approved:** For the case when two inference reports have CSI reference resources with same minimal offset to the monitoring transmission occasion, the UE may use both two inference reports may be used for the evaluation of whether a transmission occasion is an accurate reference signal prediction instance.

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| **TP#8**  5.2.1.4.3b RS-PAI Reporting  When the UE is configured with a first CSI Reporting Setting for reporting P-CRI, P-SSBRI, and/or P-L1-RSRP, based on a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', and a second CSI Reporting Setting for reporting RS-PAI, based on a *CSI-ReportConfig* with *reportQuantity-r19* set to 'rs-pai-r19', and the second Reporting Setting is linked to the first Reporting Setting by *inferenceReportConfigId-r19*, the reporting of RS-PAI corresponding to the second CSI Reporting Setting shall consider the following:  - for each of the *nroftransmissionOccasion-r19* latest transmission occasion(s), where the latest transmission occasion of *nroftransmissionOccasion-r19* latest transmission occasion(s), and the latest report of the first CSI Reporting Setting considered for linking, are no later than the CSI reference resource corresponding to the CSI report of the second CSI Reporting setting, the UE shall:  - perform L1-RSRP measurements for the configured CSI-RS resources, or SS/PBCH Block resources, associated with the transmission occasion of the corresponding Resource Set for channel measurement of the second CSI Reporting Setting;  - determine the best *nrofBestBeamforMonitoring-r19* CSI-RS resources, or SS/PBCH Block resources based on L1-RSRP(s) measured CSI-RS resources, or SS/PBCH Block resources of the corresponding Resource Set;  - check a condition :  - for the transmission occasion of the second CSI Reporting Setting, there is a linked report of the first CSI Reporting Setting. When *nroftimeinstance-r19* is not configured in the first Reporting Setting, the linking is determined if CSI reference resource of a report of the first CSI Reporting Setting has a minimal slot offset, no larger than 64 slots, from the slot of the transmission occasion of the corresponding Resource Set for channel measurement of the second CSI Reporting Setting. When *nroftimeinstance-r19* is configured in the first Reporting Setting, *timeinstanceformonitoring-r19* configured in the second CSI Reporting Setting indicates the *timeinstanceformonitoring-r19*-thtime instance among *nroftimeinstance-r19* time instance(s), and the linking is determined if the slot corresponding to the time instance indicated by *timeinstanceformonitoring-r19* of a report of the first CSI Reporting Setting has a minimal slot offset, no larger than 64 slots, from the slot of the transmission occasion of the corresponding Resource Set for channel measurement of the second CSI Reporting Setting. If two reports of the first CSI Reporting Setting are linked to one transmission occasion of the second CSI Reporting Setting, one is randomly selected as the linked report.  - at least one of the *nrofBestBeamforMonitoring-r19* identified CSI-RS resources, or SS/PBCH Block resources is mapped one of the *nrofreportedpredictedrs-r19* reported P-CRI(s) or P-SSBRI(s), of the linked report of the first CSI Reporting Setting, wherein the mapping between CSI-RS resources, or SS/PBCH Block resources of Resource Set for channel measurement of the second CSI Reporting Setting and CSI-RS resources, or SS/PBCH Block resources of Resource Set given by *resourcesForSetA-r19* of the first CSI Reporting Setting is provided by the higher layer parameter *RSMappingtoSetA* in the second CSI Reporting Setting.  - if this condition is met, the transmission occasion is counted as an accurate reference signal prediction instance; otherwise, it is not counted as an accurate reference signal prediction instance.  - the UE shall determine RS-PAI as the total count of accurate reference signals prediction instance(s), and the UE shall report RS-PAI for the second Reporting Setting, with a -bit field (*M* is given by *nroftransmissionOccasion-r19*). |

Based on the summary above, issues and corresponding proposals are provided as follows.

### **Issue 2.2.1# Mapping between Set A and monitoring resource set**

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| --- |
| Agreement (RAN1#120bis)  For calculation the performance metric of Type 1 Option 2 performance monitoring for UE-sided model:   * + Support the size of a set for monitoring is the same as the size of Set A,     - The n-th resource in the set for monitoring is linked to the n-th resource in Set A.   + Support the size of a set for monitoring is smaller than the size of Set A   Agreement (RAN1#121)  For calculation the performance metric of Type 1 Option 2 performance monitoring for UE-sided model, when the size of the set for monitoring is smaller than the size of Set A,   * support the mapping of the resources in the set for monitoring to resources in Set A is configured via RRC, support   + A X-bit bitmap with Y non-zero bits is configured by the RRC in CSI Report Config for monitoring, where X is the size of Set A and Y is the size of the set for monitoring   + The x-th MSB of the bitmap corresponds to x-th resource in Set A   + The y-th nonzero bit of the bitmap corresponds to the y-th entry of associated *nzp-CSI-RS-Resources* or *csi-SSB-ResourceList* in the set for monitoring, 1≤y≤Y |

As pointed out by several companies [1,3,7,8,15], the yellow highlighted part of the agreement related to resource mapping is not fully captured. Hence, a corresponding text proposal is provided to address this issue.

##### **Proposal. 2.2.1**

Adopt the following TP for mapping between Set A and monitoring resource set.

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| **TP for TS 38.214 Clause 5.2.1.4.3b RS-PAI Reporting**  5.2.1.4.3b RS-PAI Reporting  <omitted texts>  - at least one of the *nrofBestBeamforMonitoring-r19* identified CSI-RS resources, or SS/PBCH Block resources is mapped one of the *nrofreportedpredictedrs-r19* reported P-CRI(s) or P-SSBRI(s), of the linked report of the first CSI Reporting Setting, wherein  - if the number of resources in the resource set for the second CSI Reporting Setting is smaller than the number of resources in the resource set given by *resourcesForSetA-r19*, the mapping between CSI-RS resources, or SS/PBCH Block resources of Resource Set for channel measurement of the second CSI Reporting Setting and CSI-RS resources, or SS/PBCH Block resources of Resource Set given by *resourcesForSetA-r19* of the first CSI Reporting Setting is provided by the higher layer parameter *RSMappingtoSetA* in the second CSI Reporting Setting;  - if the number of resources in the resource set for the second CSI Reporting Setting is the same as the number of resources in the resource set given by *resourcesForSetA-r19*,the n-th resource of the resource set for channel measurement of the second CSI Reporting Setting is mapped to the n-th resource of the resource set given by *resourcesForSetA-r19*;  - if this condition is met, the transmission occasion is counted as an accurate reference signal prediction instance; otherwise, it is not counted as an accurate reference signal prediction instance;  <omitted texts> |

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| Company | Y/N | Comments |
| FL |  | Please share your view on the TP for mapping between Set A and monitoring resource set. |
| Huawei, HiSilicon | Y |  |
| Xiaomi |  | Support |
| SPRD | Y |  |
| Ofinno | Y |  |
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### **Issue 2.2.2# Collision handling of CSI report for monitoring and other signals/channels**

In [2], it is proposed by Google that the collision handling rule for CSI report for monitoring and other signals/channels shall follows the same rule for legacy beam report.

##### **Proposal. 2.2.2**

The collision handling rule for legacy beam report and other signals/channels is reuse for CSI report for monitoring.

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| Company | Y/N | Comments |
| FL |  | This is a natural proposal by extending the collision handling rule for legacy beam report to the CSI report for monitoring.  If agreeable, can Google or other companies help to provide a full Draft TP for further check? |
| Huawei, HiSilicon |  | Not clear the intention: does it mean CSI priority for monitor CSI report? |
| Xiaomi |  | Ok |
| SPRD |  | We believe that currently no new values have been introduced for the priority of monitoring reports. This already indicates that the monitoring reports and those not based on AI have the same priority. Therefore, no further explanation is necessary. |
| Ofinno |  | Same as mentioned in Proposal 2.1.7 |
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### **Issue 2.2.3# The condition for dropping CSI report for monitoring**

In [2], it is proposed by Google that the dropping of CSI report for monitoring is based on at least one of 1) the reception of RS occasions for monitoring; 2) measured L1-RSRP is above a given threshold; 3) the reception of RS occasions for channel measurement for the associated CSI report for inference. Also, similar proposed is provided by Samsung [4] considering the first condition. In [4], vivo proposed to restrict UE from submitting reports until the configured number of monitoring instances is achieved. In [14], NEC propose to stop the report for monitoring when the associated CSI report for inference is stopped.

##### **Proposal. 2.2.3**

Support the following on the reporting condition of CSI reporting for monitoring

* UE transmit a CSI report for monitoring only if receiving at least *nroftransmissionOccasion-r19* latest transmission occasion for each of the RS resources in the resource set for monitoring no later than the corresponding CSI reference resource within the same DRX active time.

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| Company | Y/N | Comments |
| FL |  | The proposal is formulated based on legacy principle considering the reception of RS occasions for monitoring. |
| Huawei, HiSilicon | Y | Same rule as BM-Case 2 and R18 CSI prediction. |
| Xiaomi |  | Ok |
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### **Issue 2.2.4# Configuration restriction on AP CSI report configuration for monitoring**

Nokia [11] proposed to restrict *nroftransmissionOccasion-r19* to 1 in case of AP CSI report for monitoring with the associated AP CSI report for inference.

##### **Proposal. 2.2.4**

Adopt the following TP for AP CSI report configuration for monitoring.

**Reason for change**: To ensure that monitoring results are properly calculated at the UE, it is to clarify that for AP Report for inference, the number of transmission occasions triggered by AP report for monitoring should be limited to M = 1. With this limitation, AP monitoring of AP inference is not useful, though there may be alternative ways to address this issue.

**Summary of change**: For AP Report for inference, limit the number of transmission occasions triggered by AP report for monitoring to M = 1.

**Consequence if not approved:** If this change is not implemented, there could inconsistencies in determining monitoring results at the UE.

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| 5.2.1.4.3b RS-PAI Reporting  When the UE is configured with a first CSI Reporting Setting for reporting P-CRI, P-SSBRI, and/or P-L1-RSRP, based on a *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19' or 'p-ssb-index-RSRP-r19', and a second CSI Reporting Setting for reporting RS-PAI, based on a *CSI-ReportConfig* with *reportQuantity-r19* set to 'rs-pai-r19', and the second Reporting Setting is linked to the first Reporting Setting by *inferenceReportConfigId-r19*, the reporting of RS-PAI corresponding to the second CSI Reporting Setting shall consider the following:  < Unchanged parts are omitted >  - determine RS-PAI as the total count of accurate reference signals prediction instance(s), and the UE shall report RS-PAI for the second Reporting Setting, with a -bit field (*M* is given by *nroftransmissionOccasion-r19*).  When both the first and the second CSI Reporting Settings are aperiodic, the UE is not expected to configure with a value larger than 1 for *nroftransmissionOccasion-r19.*  < Unchanged parts are omitted > |

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| Company | Y/N | Comments |
| FL |  | Please share your view on the TP. |
| Huawei, HiSilicon |  | We do not see essential issue of configuring *nroftransmissionOccasion-r19* larger than 1 for A-CSI report. Some elaborations are needed. |
| Xiaomi |  | It can be controlled by NW. |
| SPRD | N | There is no need to introduce this restriction. Even if the number of configurations is greater than 1, the UE can still perform the calculation. If NW believes that the calculation results obtained with a configuration greater than 1 are incorrect, NW can simply configure the case where the value is exactly 1. |
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### **Issue 2.2.5# Clarification on the reference time for the determination of linked inference report**

Xiaomi [5] proposed to clarify the reference time for the determination of linked inference report.

##### **Proposal. 2.2.5**

The first or last slot of the CSI-RS/SSB resources of the transmission occasion for monitoring is used to determine the linked inference report.

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| Company | Y/N | Comments |
| FL |  | Please share your view on the proposal. |
| Huawei, HiSilicon |  | We prefer the first slot. It is easier to configure regular monitor RS pattern between two adjacent Set Bs. |
| Xiaomi |  | Support and either first or last is ok for us. |
| SPRD | Y |  |
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### **Issue 2.2.6# Clarification on the P-CRI/P-SSBRI for monitoring in BM-Case2**

Samsung [7] proposed a TP to clarify the P-CRI/P-SSBRI for monitoring in BM-Case2.

##### **Proposal. 2.2.6**

Adopt the following TP for CSI reporting for monitoring.

**Reason for change:** The condition associated with CSI reporting for RS-PAI is unclear.

**Summary of change:** Clarify that the *timeinstanceformonitoring-r19*-thtime instance is used in case of BM-Case2 for condition check. Adding the description on resource mapping methods depending on the size of the set for monitoring is smaller than or the same as the size of Set A.

**Consequences if not approved:** gNB and UE may have different understanding on the condition associated with CSI reporting for RS-PAI.

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| **TP for TS 38.214 Clause 5.2.1.4.3b RS-PAI Reporting**  5.2.1.4.3b RS-PAI Reporting  <omitted texts>  - at least one of the *nrofBestBeamforMonitoring-r19* identified CSI-RS resources, or SS/PBCH Block resources is mapped one of the *nrofreportedpredictedrs-r19* reported P-CRI(s) or P-SSBRI(s), for the *timeinstanceformonitoring-r19*-thtime instance if *nroftimeinstance-r19* is configured, of the linked report of the first CSI Reporting Setting, wherein the mapping between CSI-RS resources, or SS/PBCH Block resources of Resource Set for channel measurement of the second CSI Reporting Setting and CSI-RS resources, or SS/PBCH Block resources of Resource Set given by *resourcesForSetA-r19* of the first CSI Reporting Setting is provided by the higher layer parameter *RSMappingtoSetA* in the second CSI Reporting Setting;  - if this condition is met, the transmission occasion is counted as an accurate reference signal prediction instance; otherwise, it is not counted as an accurate reference signal prediction instance;   * determine RS-PAI as the total count of accurate reference signals prediction instance(s), and the UE shall report RS-PAI for the second Reporting Setting, with a -bit field (*M* is given by *nroftransmissionOccasion-r19*).   <omitted texts> |

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| Company | Y/N | Comments |
| FL |  | This is needed to clarify that the P-CRI/P-SSBRI for the *timeinstanceformonitoring-r19*-th time instance is used for BM-Case2. |
| Xiaomi |  | We are fine with the principle, but it seems that the new added parts means it only applied for BM case 2. We suggest the updates below  For *nroftimeinstance-r19* is not configured, or for the *timeinstanceformonitoring-r19*-thtime instance if *nroftimeinstance-r19* is configured, |
| SPRD |  | Similar view with Xiaomi. |
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### **Issue 2.2.7# Correction on the determination of Top beams in resource set for monitoring**

LG [12] proposed a TP to correct the description on the determination of Top beams in resource set for monitoring.

##### **Proposal. 2.2.7**

Adopt the following TP on the Top beams in resource set for monitoring.

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| 5.2.1.4.3b RS-PAI Reporting  <omitted texts>  - for each of the *nroftransmissionOccasion-r19* latest transmission occasion(s), where the latest transmission occasion of *nroftransmissionOccasion-r19* latest transmission occasion(s), and the latest report of the first CSI Reporting Setting considered for linking, are no later than the CSI reference resource corresponding to the CSI report of the second CSI Reporting setting, the UE shall:  - perform L1-RSRP measurements for the configured CSI-RS resources, or SS/PBCH Block resources, associated with the transmission occasion of the corresponding Resource Set for channel measurement of the second CSI Reporting Setting;  - determine ~~the best~~ *nrofBestBeamforMonitoring-r19* CSI-RS resources, or SS/PBCH Block resources based on largest L1-RSRP~~(s)~~ value(s) of measured CSI-RS resources, or SS/PBCH Block resources of the corresponding Resource Set;  <omitted texts> |

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| Company | Y/N | Comments |
| FL |  | This change is consistent with existing specification language. |
| Xiaomi |  | ok |
| SPRD | Y |  |
| Ofinno | Y |  |
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### **Issue 2.2.8# Minimal slot offset determination**

Apple [13] proposed to discuss whether semi-static TDD DL/UL patterns are considered in determining the minimal slot offset.

##### **Discussion point**

* Whether semi-static TDD DL/UL patterns are considered in determining the minimal slot offset.
* If needed, what is the specification impact.

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| Company | Y/N | Comments |
| FL |  | In TS38.214-j00, “reported P-CRI(s) or P-SSBRI(s)” is used for condition check of RS-PAI, which implies that the linked report is actually transmitted after the consideration of semi-static TDD DL/UL patterns. Please share your view on the discussion point. |
| Huawei, HiSilicon |  | Another issue related to TDD DL/UL pattern: if a UL slot collides with RS occasion of monitoring, whether to count it to the calculation of RS-PAI? |
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### **Others**

HW [1] proposed 2 cases to determine monitoring RS occasions for RS-PAI calculation. However, based on the common understanding in RAN#121 (as mentioned by LG [12]) that the N latest monitoring RS occasions are used for RS-PAI calculation, regardless of the N latest monitoring RS occasions have linked inference report or not.

LG [12] and vivo [4] proposed CSI report for monitoring includes new quantities other than RS-PAI. However, it is too late to introduce new report quantity in CR phase.

Panasonic [10] and LG [12] proposed to support aperiodic CSI-RS for the type of resource for performance monitoring. This issue was discussed in the past several meetings but no consensus was reached.

Apple [13] proposed the detailed procedure for performance monitoring for AI/ML BM. However, it is unclear how to consolidate the procedure in the current specification.

Sharp [21] proposed a TP for the clarification of the linked CSI report for inference. However, even without the suggested TP implies, UE can use the same method by implementation. Hence, the TP is not needed.

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| Company | Comments |
| FL | Please share your comments and suggestions, if any. |
| Huawei, HiSilicon | We pointed out an issue in our paper on the duplicated mapping of more than one monitor RS to one predicted result, which will cause unnecessary counting of RS-PAI. This issue is not treated.  ***Proposal 11: For monitoring of UE-side model, considering the case of A-CSI report for inference and P/SP-CSI-RS for monitoring, duplicated mapping from more than one monitoring RS to one prediction result should be precluded when determining the conditions of linked pairs.*** |
| Ofinno | For performance monitoring, we pointed out an issue on the consistency of the prediction accuracy metric when the monitoring set is configured as a subset of Set A. To ensure that the metric reflects the prediction-to-measurement linkage, we propose to clarify that the monitoring should be aligned with the Top-K′ predicted beams among the monitoring set. This is not for an overhead optimization, but a necessity to ensure the validity and comparability of the prediction accuracy metric. The proposed clarification guarantees that the performance monitoring metric reflects the same prediction-to-measurement linkage, thus ensuring interoperability and reliable evaluation. |
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## 2.3 APU/CPU

**Huawei**

**Table 3 Text proposal for PU occupation rule**

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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 non-zero , 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. For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', or CSI reports configured with the higher layer parameter *[RRC\_name-r19],* is considered.  For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]*, the UE may indicate a second value for the number of supported simultaneous CSI calculations with parameter *SecondValuesSimultaneousCSI-ReportsPerCC* in a component carrier, and *SecondValuesSimultaneousCSI-ReportsAllCC* across all component carriers, in addition to . 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 CSI reports start occupying their respective CPUs on the same OFDM symbol on which CPUs are unoccupied, where each CSI report corresponds to non-zero , 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.  For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]* if a CSI report with non-zero and is not considered within any of and , the values for  and are considered to be 0~~,~~ for the procedure previously described in this clause and the UE is not required to update the CSI report. |

**Proposal 13: For the PU occupation rule, only the CSI reports requiring to occupy both CPU and APU (i.e., non-zero OCPU,1 and non-zero OCPU,2) but not considered within any of M and M2 are not required to update.**

* **For a CSI report which requires to occupy CPU only (OCPU,2=0) /APU only (OCPU,1=0), it should be exempted from being blocked for CPU/APU occupation (and corresponding CSI update) if the APU/CPU pool, respectively, cannot satisfy the required occupation of this CSI report.**
* **Consider the text proposal in Table 3 for the PU occupation part in 38.214.**

**Proposal 14: For monitoring of UE-side model, regarding the CPU occupancy rule,** **separately count the CPU occupation for each individually monitoring RS occasion:**

* **For P/SP-CSI report:**
  + **For the last monitoring RS occasion, CPU is occupied from the first symbol of the earliest RS to symbols after the last symbol of the latest RS.**
  + **For the N-th till second last monitoring RS occasion, CPU is occupied from the first symbol of the earliest of each monitoring RS occasion to symbols after the last symbol of the latest monitoring RS in each occasion.**
* **For A-CSI report: CPU is occupied from the first symbol of the earliest of each RS occasion to symbols after the last symbol of the latest RS of each RS occasion, and from after PDCCH to the PUSCH.**
* **APU is not occupied.**

**Google**

**Proposal 3: Endorse the following TP for 38.214 to capture the agreement in RAN #108 that the proposal in RP-251823 is endorsed.**

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| 5.2.1.6 CSI processing criteria <omitted text>  For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]*, the UE may indicate a second value and a third value for the number of supported simultaneous CSI calculations , with parameter *SecondValuesSimultaneousCSI-ReportsPerCC* and *ThirdValuesSimultaneousCSI-ReportsPerCC* in a component carrier, and *SecondValuesSimultaneousCSI-ReportsAllCC* and *ThirdValuesSimultaneousCSI-ReportsAllCC* across all component carriers respectively, in addition to . 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 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. The UE reports the value of x for CSI report with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19].* |

**Proposal 4: Clarify the CPU/APU allocation based on a CPU-first operation and endorse the following TP for 38.214.**

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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. For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', or CSI reports configured with the higher layer parameter *[RRC\_name-r19],* is considered.  For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]*, the UE may indicate a second value for the number of supported simultaneous CSI calculations with parameter *SecondValuesSimultaneousCSI-ReportsPerCC* in a component carrier, and *SecondValuesSimultaneousCSI-ReportsAllCC* across all component carriers, in addition to . 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 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. The UE allocates the CPUs for the CSI reports that requires first, and then allocates the CPUs for the remaining CSI reports. |

**CATT**

**Proposal 5: For UE-sided model, regarding the CPU occupation time of a CSI report corresponding to CSI-ReportConfig for Type 1 option 2 monitoring ,**

* **If the CSI report is aperiodic, Rel-15 CPU occupation time for AP CSI report is reused**
* **If the CSI report is semi-persistent or periodic,**
  + **For the first transmission occasion of the N transmission occasion(s) of the CSI-RS/SSB resources for monitoring till the (N-1)-th latest transmission occasion(s) no later than CSI reference resource, the CPU is occupied from the first symbol of each transmission occasion of CSI-RS/SSB, until Z3' symbols after the last symbol of the latest one of the CSI-RS/SSB resource for channel measurement for L1-RSRP computation in each transmission occasion**
  + **For the last transmission occasion of the N transmission occasion(s), the CPU is occupied from the first symbol of the latest CSI-RS/SSB transmission occasion no later than CSI reference resource, until the last symbol of the PUSCH/PUCCH carrying the report.**

**vivo**

**Proposal 1. It's necessary to** **clarify that “each AI/ML feature” refers to relevant AI/ML FGs. Based on the current AI/ML UE feature list, at least FG, UE-side beam prediction for BM Case1 [for inference] (FG 58-1-2), UE-side beam prediction for BM Case1 with predicted RSRP [for inference] (FG 58-1-3), UE-side beam prediction for BM Case2 [for inference] (FG 58-1-4) and UE-side beam prediction for BM-Case2 with predicted RSRP [for inference] (FG 58-1-5), shall contain which AI/ML PU pool it belongs to when N=2.**

**ZTE**

**Text Proposal 3: To adopt the following changes in section 5.2.1.6, TS 38.214.**

**Summary of change:** For UE-sided model, regarding a CSI report with *CSI-ReportConfig* for monitoring, Rel-15 CPU occupation time is reused for CPU occupation time of the CSI report. Notably, this is applicable to all types of CSI reports (i.e., AP/SP/P CSI report).

**Consequence if not approved:** The CPU occupation time of the monitoring report is not aligned between the gNB and UE, leading to inefficient CSI report scheduling.

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| **5.2.1.6 CSI processing criteria**  <Unchanged part is omitted>  For a CSI report with *CSI-ReportConfig* with higher layer parameter *reportQuantity* not set to 'none', or a CSI report with *LTM-CSI-ReportConfig*, or *reportQuantity* not set to 'none-bm-r19' or 'none-csi-r19', the CPU(s) (including and/or , for CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19' or 'rs-pai-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]* 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 and a semi-persistent CSI report on PUSCH configured with the higher layer parameter *codebookType* set to 'typeII-Doppler-r18' or 'typeII-Doppler-PortSelection-r18') 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-ReportSubConfigToAddModList*, 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-ReportSubConfigToAddModList*, 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.  - An aperiodic CSI report occupies CPU(s) from the first symbol after the PDCCH triggering the CSI report until the last symbol of the scheduled PUSCH carrying the report. When the PDCCH reception includes two PDCCH candidates from two respective search space sets, as described in clause 10.1 of [6, TS 38.213], for the purpose of determining the CPU occupation duration, the PDCCH candidate that ends later in time is used.  - An initial semi-persistent CSI report on PUSCH after the PDCCH trigger occupies CPU(s) from the first symbol after the PDCCH until the last symbol of the scheduled PUSCH carrying the report. When the PDCCH reception includes two PDCCH candidates from two respective search space sets, as described in clause 10.1 of [6, TS 38.213], for the purpose of determining the CPU occupation duration, the PDCCH candidate that ends later in time is used.  - A semi-persistent CSI report on PUSCH configured with the higher layer parameter *codebookType* set to 'typeII-Doppler-r18' or 'typeII-Doppler-PortSelection-r18' occupies CPU(s) from the first symbol of *KP*-th latest consecutive periodic/semi-persistent CSI-RS occasions no later than CSI reference resource, until the last symbol of the PUSCH carrying the report, where the value of is indicated by UE capability.  <Unchanged part is omitted> |

**Samsung**

**Proposal 5: Adopt the following TP for TS 38.214 Clause 5.2.1.6 for CSI report for inference.**

**Reason for change:** The *M* and *M*2 for determining whether CSI reporting for inference is required to be updated or not is unclear.

**Summary of change:** Clarify that the *M* and *M*2 are determined prior to any of CSI report with corresponding and considered to be 0.

**Consequences if not approved:** gNB and UE may have different understanding on the *M* and *M*2 when determining whether CSI reporting for inference is required to be updated or not.

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| **TP for TS 38.214 Clause 5.2.1.6 CSI processing criteria**  <omitted texts>  For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]*, the UE may indicate a second value for the number of supported simultaneous CSI calculations with parameter *SecondValuesSimultaneousCSI-ReportsPerCC* in a component carrier, and *SecondValuesSimultaneousCSI-ReportsAllCC* across all component carriers, in addition to . 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 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.  For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]* if a CSI report is not considered within any of and , the values for and are considered to be 0, for the procedure previously described in this clause and the UE is not required to update the CSI report, where the and are determined prior to any of CSI report with corresponding and considered to be 0.  <omitted texts> |

**LG**

**Proposal #3: CPU for monitoring report also should be occupied from N-th latest transmission occasion of the CSI-RS/SSB resources for monitoring no later than the CSI reference resource corresponding to the CSI report for monitoring, until the monitoring report is done.**

* **The CPU occupation for monitoring report could start from either the N-th latest transmission occasion of the CSI-RS/SSB resources for monitoring or corresponding linked inference report instance, which is preceding.**

**Apple**

**Proposal 4-1: To capture the agreement in RAN plenary 108 on AI/ML PU pools, adopt the following text proposal.**

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. ~~For CSI reports with~~ *~~reportQuantity~~* ~~set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', or CSI reports configured with the higher layer parameter~~ *~~[RRC\_name-r19],~~* ~~is considered.~~

For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]*, ~~the UE may indicate a second value for the number of supported simultaneous CSI calculations with parameter~~ *~~SecondValuesSimultaneousCSI-ReportsPerCC~~* ~~in a component carrier, and~~ *~~SecondValuesSimultaneousCSI-ReportsAllCC~~* ~~across all component carriers, in addition to~~ . the UE may indicate up to maximum of two supported simultaneous AI/ML-based CSI calculations with parameter *FristValueAPUSimultaneousCSI-ReportsPerCC* in a component carrier, and *FirstValueAPUSimultaneousCSI-ReportsAllCC* across all component carriers, and with parameter *SecondValueAPUSimultaneousCSI-ReportsPerCC* in a component carrier, and *SecondValueAPUSimultaneousCSI-ReportsAllCC* across all component carriers. If the UE indicates a single supported simultaneous AI/ML-based CSI calculations , the AI/ML based CSI calculation pool is for CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19' and CSI reports configured with the higher layer parameter *[RRC\_name-r19].*  If two supported simultaneous AI/ML-based CSI calculations and are reported, the first AI/ML based CSI calculation pool is with supported simultaneous AI/ML-based CSI calculations , the second AI/ML based CSI calculation pool is with supported simultaneous AI/ML-based CSI calculations . By UE capability reporting, UE indicates whether CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19' belong to either the first AI/ML based CSI calculation pool or the second AI/ML based CSI calculation pool; whether CSI reports configured with the higher layer parameter *[RRC\_name-r19]* r19' belong to either the first AI/ML based CSI calculation pool or the second AI/ML based CSI calculation pool. If APUs in the first AI/ML based CSI calculation pool and APUs in the second AI/ML based CSI calculation pool are occupied for calculation of CSI reports in a given OFDM symbol, the UE has and unoccupied APUs respectively. If CSI reports start occupying their respective A~~C~~PUs on the same OFDM symbol on which and APUs are unoccupied, where each CSI report corresponds to either or , 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 , and where is the largest value such that holds.

For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]* if a CSI report is not considered within any of , and , the values for , and are considered to be 0, for the procedure previously described in this clause and the UE is not required to update the CSI report.

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for a CSI report with *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19',

- if *nroftimeinstance-r19* is not configured, and or , where the value of , are reported by UE capability.

- if *nroftimeinstance-r19* is configured, and or , where the value of and are reported by UE capability.

- and or , for a CSI report configured with the higher layer parameter *[RRC\_name-r19],* where the values of and are reported by UE capability.

For a CSI report with *CSI-ReportConfig* with higher layer parameter *reportQuantity* not set to 'none', or a CSI report with *LTM-CSI-ReportConfig*, or *reportQuantity* not set to 'none-bm-r19' or 'none-csi-r19', the CPU(s) (including and/or , or , for CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]*) are occupied for a number of OFDM symbols as follows:

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**Sharp**

**Proposal 3: Adopt the following TP#3 in TS 38.214 to clarify that, for a CSI report whose required and are both nonzero, if any of the unoccupied PU cannot satisfy the corresponding required PU by the CSI report, the values for and of the CSI report are considered to be 0.**

**Reason for change:** An AI/ML feature can be supported by legacy CPU , AI/ML PU , or combination of legacy CPU and AI/ML PU. The current TS38.214 specified the UE behaviour that, when a CSI report is not considered within any of M and M2, the required PUs for the CSI report are considered as 0 for the procedure of determination of M CSI reports and M2 CSI reports. The specified UE behaviour should be targeted to the AI/ML feature supported by the combination of legacy CPU and AI/ML PU but not to the AI/ML feature supported by either legacy CPU or AI/ML PU. Otherwise, the unintended consequence occurs that, when an CSI report of AI/ML feature supported by either legacy CPU or AI/ML PU is in either M and M2 but not in any of M and M2, the UE is forced to release PU for the CSI report and thus not update the CSI report.

**Summary of change:** Add “and both reported and are nonzero” to clarify that, for a CSI report whose required and are both nonzero, if any of the unoccupied PU cannot satisfy the corresponding required PU by the CSI report, the values for and of the CSI report are considered to be 0

**Consequences if not approved:** When an CSI report of AI/ML feature supported by either legacy CPU or AI/ML PU is in either M and M2 but not in any of M and M2, UE is forced to release PU for the CSI report and thus not update the CSI report.

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| **TP#3**  5.2.1.6 CSI processing criteria  <unchanged parts are omitted>  For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]* if a CSI report is not considered within any of and and both reported and are nonzero, the values for and are considered to be 0, for the procedure previously described in this clause and the UE is not required to update the CSI report.  <unchanged parts are omitted> |

**Proposal 4: Adopt the following TP#4 in TS 38.214 to further clarify the “if” condition for CSI reports with both CPU/APU occupied.**

**Reason for change**: It is unclear whether a CSI report neither considered within nor would be updated based on current specs.

**Summary of change**: Change the condition as if a CSI report is considered within either or only, the UE is not required to update the CSI report.

**Consequences if not approved**: A CSI report neither considered within nor may be updated.

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| **TP#4**  5.2.1.6 CSI processing criteria  <unchanged parts are omitted>  For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]* if a CSI report is ~~not~~ considered within ~~any~~ either one of and only, the values for and are considered to be 0, for the procedure previously described in this clause and the UE is not required to update the CSI report.  <unchanged parts are omitted> |

**Proposal 5: Adopt the following TP#5 in TS 38.214 to support N=2 AI/ML PU pools for AI/ML features and one AI/ML feature is designated to one AI/ML PU pool.**

**Reason for change**:RANP#108 agreed that a UE can report support for up to 2 AI/ML PU pools for AI/ML features. However, the current TS38.214 only specify UE behaviours of supporting 1 AI/ML PU pool.

**Summary of change**: Add relevant descriptions to support the case of 2 AI/ML PU pools in specification.

**Consequences if not approved**: TS 38.214 cannot support the case of 2 AI/ML PU pools.

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| **TP#5**  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. For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', or CSI reports configured with the higher layer parameter *[RRC\_name-r19],* is considered.  For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]*, the UE may indicate a second value for the number of supported simultaneous CSI calculations with parameter *SecondValuesSimultaneousCSI-ReportsPerCC* in a component carrier, and *SecondValuesSimultaneousCSI-ReportsAllCC* across all component carriers, in addition to . 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 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.  For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]*, the UE may indicate a third value for the number of supported simultaneous CSI calculations with parameter *ThirdValuesSimultaneousCSI-ReportsPerCC* in a component carrier, and *ThirdValuesSimultaneousCSI-ReportsAllCC* across all component carriers, in addition to and . 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 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.  For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]* if a CSI report is not considered within any of and , the values for and are considered to be 0, for the procedure previously described in this clause and the UE is not required to update the CSI report.  A UE is not expected to be configured with an aperiodic CSI trigger state containing more than Reporting Settings. Processing of a CSI report occupies a number of CPUs for a number of symbols as follows:  **<unchanged parts are omitted>**  - for a CSI report with *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19',  - if *nroftimeinstance-r19* is not configured, ~~and~~, , and , where the value of ~~and~~, , and are reported by UE capability.  - if *nroftimeinstance-r19* is configured, ~~and~~, , and , where the value of  ~~and~~, , and are reported by UE capability.  - ~~and~~, , and , for a CSI report configured with the higher layer parameter *[RRC\_name-r19],* where the values of ~~and~~, , and are reported by UE capability.  **<unchanged parts are omitted>** |

**Proposal 6: Adopt the following TP#6 in TS 38.214 to clarify that CPU occupation time for the model monitoring report starts from the CPU occupation of the earliest linked inference report corresponding to the nroftransmissionOccasion-r19 latest transmission occasion(s).**

**Reason for change**: CPU occupation for model monitoring CSI report is not specified yet.

**Summary of change**: Clarify that CPU occupation time for the model monitoring report starts from the CPU occupation of the earliest linked inference report corresponding to the nroftransmissionOccasion-r19 latest transmission occasion(s).

**Consequences if not approved**: UE is unable to determine the CPU occupation time for model monitoring CSI report.

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| **TP#6**  5.2.1.6 CSI processing criteria  <unchanged parts are omitted>  For a CSI report with CSI-ReportConfig with higher layer parameter reportQuantity set to 'rs-pai-r19', 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 CPU occupation time for the earliest linked report of the first CSI Reporting Setting corresponding to the *nroftransmissionOccasion-r19* latest transmission occasion(s) , until the last symbol of the configured PUSCH/PUCCH carrying the report.  <unchanged parts are omitted> |

**Proposal 7: Adopt the following TP#7 in TS 38.214 to clarify that only Set A is considered for determination of CPU occupation time for the model training CSI report.**

**Reason for change**: For model training, both Set A and Set B are configured for channel measurement. If Set B is configured as a subset of Set A (i.e. only associatedIDforSetA-r19 is configured), CPU occupation corresponding to each transmission occasion of both Set A and Set B would be summed and it leads to over-counting for CPU occupation, i.e. CPU occupation corresponding to each transmission occasion of Set B is counted twice.

**Summary of change**: Clarify that only Set A is considered for determination of CPU occupation time for the model training CSI report.

**Consequences if not approved**: CPU occupation corresponding to each transmission occasion of Set B is counted twice.

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| **TP#7**  5.2.1.6 CSI processing criteria  <unchanged parts are omitted>  For a CSI report with *CSI-ReportConfig* with higher layer parameter *reportQuantity* set to 'none-bm-r19' and if only *associatedIDforSetA-r19* is configured, the CPU(s) are occupied for a number of OFDM symbols as follows:  - A 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 transmission occasion of periodic or semi-persistent CSI-RS/SSB resource for channel measurement of the second Resource Setting, until symbols after the last symbol of the latest one of the CSI-RS/SSB resource for channel measurement for L1-RSRP computation in each transmission occasion of the second Resource Setting.  <unchanged parts are omitted> |

**DOCOMO**

**Proposal 3. For performance monitoring of beam management, reuse the CPU occupation timeline when reportQuantity is not set to ‘none’, ‘none-bm-r19’, or ‘none-csi-r19’, or a CSI report with LTM-CSI-ReportConfig, and confirm the current CR based on this proposal.**

Based on the summary above, issues and corresponding proposals are provided as follows.

### **Issue 2.3.1# CPU occupation time for CSI report for monitoring**

Several companies [1,3,6,12,21,22] discussed the CPU occupation time for CSI report for monitoring.

##### **Proposal. 2.3.1**

Adopt the following TP in section 5.2.1.6, TS 38.214.

**Summary of change:** For UE-sided model, regarding a CSI report with *CSI-ReportConfig* for monitoring, Rel-15 CPU occupation time is reused for CPU occupation time of the CSI report for all types of CSI reports (i.e., AP/SP/P CSI report).

**Consequence if not approved:** The CPU occupation time of the monitoring report is not aligned between the gNB and UE, leading to inefficient CSI report scheduling.

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| **5.2.1.6 CSI processing criteria**  <Unchanged part is omitted>  For a CSI report with *CSI-ReportConfig* with higher layer parameter *reportQuantity* not set to 'none', or a CSI report with *LTM-CSI-ReportConfig*, or *reportQuantity* not set to 'none-bm-r19' or 'none-csi-r19', the CPU(s) (including and/or , for CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19' or 'rs-pai-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]* 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 and a semi-persistent CSI report on PUSCH configured with the higher layer parameter *codebookType* set to 'typeII-Doppler-r18' or 'typeII-Doppler-PortSelection-r18') 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-ReportSubConfigToAddModList*, 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-ReportSubConfigToAddModList*, 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 part is omitted> |

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| --- | --- | --- |
| Company | Y/N | Comments |
| FL |  | This proposal is to take the TP with minimum spec impact which is also aligned with the design principle CSI report for inference for BM-Case2. For CSI report for monitoring, the proposed options of CPU occupation time are almost the same as those for CSI report for inference for BM-Case2. It is unnecessary to have a different design for this issue. |
| Xiaomi |  | Further discussion is needed. |
| SPRD | Y |  |
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### **Issue 2.3.2# TP to capture the agreement in RAN #108**

In RAN Plenary 108, the proposal in RP-251823 (Revision of RP-251658) was endorsed for AI/ML PU sharing, which extends the one AI/ML PU pool to maximum of two AI/ML PU pools.

|  |
| --- |
| * + A UE can report support for N (up to 2) AI/ML PU pools for AI/ML features     - For each of the N AI/ML PU pools, UE reports the maximum number of simultaneous AI/ML PUs, respectively.     - If N = 2, for each AI/ML feature, UE reports which AI/ML PU pool it belongs to. |

Several companies [2,13,21] provided TPs to accurately capture the agreements above. Vivo [4] proposed to clarify the “AI/ML feature” in the above agreement.

##### **Proposal. 2.3.2**

Adopt the following TP in section 5.2.1.6, TS 38.214.

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| --- |
| **5.2.1.6 CSI processing criteria**  <Unchanged part is omitted>  For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]*, the UE may indicate a second value for the number of supported simultaneous CSI calculations with parameter *SecondValuesSimultaneousCSI-ReportsPerCC* in a component carrier, and *SecondValuesSimultaneousCSI-ReportsAllCC* across all component carriers, and if applicable, a third value for the number of supported simultaneous CSI calculations with parameter *ThirdValuesSimultaneousCSI-ReportsPerCC* in a component carrier, and *ThirdValuesSimultaneousCSI-ReportsAllCC* across all component carriers, in addition to . 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 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. If only the second value is indicated, x = 2. If both of the second value and the third value are indicated, x = 2,3 where the CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19' corresponds to x = 2 or 3 subject to UE capability and the CSI reports configured with the higher layer parameter *[RRC\_name-r19]* corresponds to x = 2 or 3 subject to UE capability.  For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]* if a CSI report is not considered within any of and , the values for and are considered to be 0, for the procedure previously described in this clause and the UE is not required to update the CSI report.  <Unchanged part is omitted>  - for a CSI report with *CSI-ReportConfig* with *reportQuantity-r19* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19',  - if *nroftimeinstance-r19* is not configured, and , where the value of and are reported by UE capability.  - if *nroftimeinstance-r19* is configured, and , where the value of and are reported by UE capability.  - and , for a CSI report configured with the higher layer parameter *[RRC\_name-r19],* where the values of and are reported by UE capability.  For a CSI report with *CSI-ReportConfig* with higher layer parameter *reportQuantity* not set to 'none', or a CSI report with *LTM-CSI-ReportConfig*, or *reportQuantity* not set to 'none-bm-r19' or 'none-csi-r19', the CPU(s) (including and/or , for CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]*) are occupied for a number of OFDM symbols as follows:  <Unchanged part is omitted> |

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| Company | Y/N | Comments |
| FL |  | This is a merged TP based on the input from companies to reflect the agreement in RAN #108. |
| Huawei, HiSilicon |  | OK in general. |
| Xiaomi |  | Further discussion is needed. |
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### **Issue 2.3.3#** **The determination of updated CSI reports based on CPU and APU**

Several companies [1,2,7,21] provided TPs to clarify the procedure for the determination of updated CSI reports based on CPU and APU. HW [1] proposed to handle the procedure for CPU and APU in parallel and release the CPU/APU occupation based on the outcome. Also, HW [1] and Sharp [21] proposed only CSI report with nonzero and nonzero are considered. Google [2] proposed to handle the procedure in sequential manner, i.e., CPU first, APU second. Samsung [7] proposed to clarify the M and M2 for the determination of CSI reports with and considered to be 0.

##### **Proposal. 2.3.3**

Adopt the following TP in section 5.2.1.6, TS 38.214.

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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 non-zero , 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. For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', or CSI reports configured with the higher layer parameter *[RRC\_name-r19],* is considered.  For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]*, the UE may indicate a second value for the number of supported simultaneous CSI calculations with parameter *SecondValuesSimultaneousCSI-ReportsPerCC* in a component carrier, and *SecondValuesSimultaneousCSI-ReportsAllCC* across all component carriers, in addition to . 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 CSI reports start occupying their respective CPUs on the same OFDM symbol on which CPUs are unoccupied, where each CSI report corresponds to non-zero , 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.  For CSI reports with *reportQuantity* set to 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', and CSI reports configured with the higher layer parameter *[RRC\_name-r19]* if a CSI report with non-zero reported and non-zero reported is not considered within any one of and , the values for and are considered to be 0, for the procedure previously described in this clause and the UE is not required to update the CSI report, where the and are determined prior to any of CSI report with corresponding and considered to be 0. |

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| Company | Y/N | Comments |
| FL |  | This is a merged TP based on the input from companies. |
| Huawei, HiSilicon | Y | Editorial change to make the meaning crystal clear:  is not considered within any one of and , => is not considered within ~~any one of~~ and is not considered within , |
| Xiaomi |  | it can be updated together with two APU pools later. |
| SPRD |  | It should be discussed after 2 APU pools. |
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## 2.4 Associated ID

**Huawei**

**Proposal 4: For UE assumption of associated ID, if the associated ID for Set B/Set A is absent, UE may assume similar properties over the collected Set B/Set A with absent associated ID in the same cell, respectively.**

**Proposal 5: For UE assumption of associated ID, the property for a resource set of Set A/Set B is interpreted with the ascending order of the entries of the corresponding resource set.**

**Proposal 6: For UE assumption of associated ID, regarding A-CSI report with multiple resource sets in one CSI report configuration, UE assumes the associated ID is applicable to the actually transmitted Set A/Set B.**

* **From NW implementation perspective, it can simply configure all resource sets with the similar property into the corresponding resource set list.**

**Google**

**Proposal 1: For Set A/B RS, clarify that UE should ignore its TCI state to maintain the consistency of associated ID and adopt the following TP for 38.214.**

|  |
| --- |
| 5.2.1.4.1 Resource Setting configuration <omitted text>  For a UE configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity-r19* is set to 'none-bm-r19', 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', if the same Associated ID is configured to be associated with different resource sets, the UE may assume similar properties for the CSI-RS resources and/or SS/PBCH block resources among those different resource sets, irrespective of when the corresponding Resource Setting(s) is configured by higher layer signalling or released, and the UE shall ignore the indicated TCI state. |

**vivo**

**Proposal 1: For inference, for UE-side model, introduce an area ID along with the configuration of associated ID to indicate how to interpret the associated ID for further address consistency issue.**

**Xiaomi**

**Proposal 1: Support cell group specific associated ID.**

**OPPO**

**Proposal 6: For BM-Case1 and BM-Case2 with NW-side model, it is NOT necessary to specify UE-side additional condition on UE Rx beamforming.**

**Proposal 14: For inference with UE-side model, support that each associated ID corresponds to a Set B and a Set A as a triple of {associated ID, Set B, Set A} configured within CSI framework.**

**Proposal 15: To ensure the flexibility on NW-side additional condition, support to configure multiple sets of {associated ID, Set B, Set A}.**

**LG**

**Proposal #4: Define similar properties of a DL Tx beam set (for Set A and/or Set B) that at least the same downlink spatial domain transmission filters are maintained for each beam in different transmission instances.**

**Proposal #5: Endorse the following TP for TS38.214.**

|  |
| --- |
| <S5.2.1.4.1>  ============================= unchanged parts are omitted ============================  For a UE configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity-r19* set to 'none-bm-r19', 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', the UE may be configured with one or two Associated ID(s) in *CSI-ReportConfig*:  - if only *associatedIDforSetA-r19* is configured, it is associated with the resource sets of the second Resource Setting*,* and the UE expects that all CSI-RS resources or SS/PBCH block resources in the resource set of the first Resource Setting are among the CSI-RS resources and/or SS/PBCH block resources in the resource set of the second Resource Setting.  - if *associatedIDforSetA-r19* and *associatedIDforSetB-r19* are configured*,* they are associated withthe resource set of the second Resource Setting and of the first Resource Setting, respectively.  For a UE configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity-r19* is set to 'none-bm-r19', 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', or 'p-ssb-index-RSRP-r19', if the same Associated ID is configured to be associated with different resource sets, the UE may assume ~~similar~~the same properties of downlink spatial domain transmission filters for the CSI-RS resources and/or SS/PBCH block resources among those different resource sets, irrespective of when the corresponding Resource Setting(s) is configured by higher layer signalling or released.  ============================= unchanged parts are omitted ============================ |

**Panasonic**

**Proposal 9: Support to apply concept of “associated IDs” for multiple cells for ensuring consistency of NW-side additional condition across training and inference for UE-sided model for BM-Case 1 and BM Case 2.**

**Proposal 10: Support to determine “associated IDs” within a NW operator (or an MNO) to preserve proprietary information.**

**Lenovo**

**Proposal 1: For aperiodic CSI report for beam inference, the associated ID should be configured for the *CSI-AperiodicTriggerState*.**

**ETRI**

**Proposal 1: For management of the Associated ID, additional discussions concerning this similar property are needed.**

**Proposal 2: With the same Associated ID, the UE may assume one of the following**

* **If two resource sets in training and inference have the same number of resources, the UE may assume that the order of two resource sets are identical.**
* **If two resource sets in training and inference have different number of resources, the UE may assume that the same TCI-State information represents the same beam direction.**

**Proposal 3: For the UE-sided model, support to provide the time information together with the Associated ID.**

**Ericsson**

**Proposal 2. For UE-sided model, for aPeriodic CSI inference report configuration, when set B is NOT a subset of set A, the resourceConfig for set B can only include a single resourceSet.**

Based on the summary above, issues and corresponding proposals are provided as follows.

### **Issue 2.4.1# Associated ID for Set B**

Several companies proposed to clarify the associated ID for Set B in case of AP CSI report for inference (where multiple Set B can be configured in a CSI resource setting). HW [1] proposed that UE assumes the associated ID is applicable to the actually transmitted set from the multiple resource sets. Lenovo [16] proposed that associated ID can be configured in AP trigger state which can indicate the associated ID for the selected resource set. Ericsson [19] proposed that if only a single resource set can be configured for Set B for CSI report for inference when set B is not a subset of set A.

##### **Proposal. 2.4.1**

Down-select one of the following alternatives on AP CSI report for inference, regarding the associated ID for aperiodic CSI resource setting with multiple resource sets for Set B

* Alt-1. Associated ID in CSI report configuration is for the selected resource set for Set B
  + Note: It is up to NW implementation to ensure the multiple resource sets are with the similar property
  + Note: This does not have specification impact
* Alt-2. Associated ID can be configured for the aperiodic CSI trigger state for the selected Set B.
* Alt-3. Only include a single resource set can be configured for Set B when set B is NOT a subset of set A.

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| Company | Y/N | Comments |
| FL |  | In general, companies are open to have multiple resource sets for Set B in case of AP CSI report. Three alternative are formulated based on input from companies. Please share your view on the preferred alternative. |
| Huawei, HiSilicon |  | Prefer Alt-1. Since associated ID represents NW side additional condition which is related with beam codebook/angle, etc., we do not see there is a strong need to have multiple different additional conditions at the same time. Therefore, even there are multiple candidate Set Bs in one A-CSI report, it is natural that they correspond to the same additional condition. So, it is easy to ensure the associated ID is applicable to the selected Set B |
| SPRD | Alt-1 |  |
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### **Issue 2.4.2# Clarification on the UE assumption for associated ID**

HW [1] and ETRI [17] proposed to further clarify the property for a resource set for UE assumption of associated ID.

##### **Proposal. 2.4.2**

For UE assumption of associated ID,

* the property for a resource set of Set A/Set B is interpreted with the ascending order of the entries of the corresponding resource set.

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| Company | Y/N | Comments |
| FL |  | Please share your view on the proposal. |
| Huawei, HiSilicon | Y |  |
| Xiaomi |  | Ok |
| SPRD |  | We are not quite clear about the motivation behind this proposal. |
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### **Issue 2.4.3# Associated ID is mandated or not**

HW [1] proposed to defined the default UE assumption when associated ID is absent.

##### **Discussion point**

Please share your view on the following

* Alt-1. Associated ID is mandated to be configured
* Alt-2. Associated ID can be absent. If not configured, what is the default UE assumption.

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| Company | Alt-1/Alt-2 | Comments |
| FL |  | Please share your preference on the discussion point. |
| Huawei, HiSilicon | Alt-2 | AI BM is UE feature; if any UE supports AI BM feature, then the associated ID must be configured, it means that gNB needs to always ensure the capability of sorting out the additional condition and give them IDs, which is challenging. |
| SPRD | Alt-1 | The UE needs to know the associated ID in order to determine whether AI inference can be performed. And not configuring the associated ID does not save any overhead. Instead, it will introduce more UE assumptions. |
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### **Others**

vivo [4] proposed to introduce an area ID for associated ID.

OPPO [9] proposed a triple of {associated ID, Set B, Set A}.

Xiaomi [5] proposed that associated ID is cell group specific. Panasonic [10] proposed that associated ID is for multiple cells. Panasonic [10] proposed that “associated IDs” within a NW operator (or an MNO) to preserve proprietary information.

OPPO [9] proposed that it is not necessary to specify UE-side additional condition on UE Rx beamforming.

LG [12] proposed that the same downlink spatial domain transmission filters are maintained for each beam in different transmission instances for the same associated ID.

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| Company | Comments |
| FL | Please share your comments and suggestions, if any. |
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## 2.5 CSI processing Timeline

**Qualcomm**

**Proposal 1: Introduce a new timeline for AI/ML P/SP CSI reports by updating the definition of CSI reference resource for AI/ML P/SP CSI reports. To this end, introduce for CSI reference resource of AI/ML CSI reports (which is larger compared to legacy non-AI/ML CSI reports), where is reported via UE capability.**

**Proposal 2: For aperiodic AI/ML CSI report with periodic or semi-persistent CSI-RS/CSI-IM or SSB, the UE is not expected to measure channel/interference on the CSI-RS/CSI-IM/SSB whose last OFDM symbol is received up to symbols before transmission time of the first OFDM symbol of the aperiodic CSI reporting.**

* **is added to the legacy value of , and can be the same as the values agreed for AP AI/ML CSI report with AP resource.**

Based on the summary above, issues and corresponding proposals are provided as follows.

### **Issue 2.5.1# New definition of CSI reference resource for P/SP CSI report for inference**

Qualcomm [20] proposed to revisit the definition of CSI reference resource for P/SP CSI report for inference. This will help to relax the processing timeline for AI/ML based CSI report.

##### **Proposal. 2.5.1**

**Introduce a new timeline for P/SP CSI report for inference by updating the corresponding definition of CSI reference resource**

* 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.
  + is reported via UE capability and

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comments |
| FL |  | This proposal is formulated based on company input. Please share your view on the proposal. |
| Huawei, HiSilicon | N | The SP CSI report timeline is not revisited for R18 CSI prediction which also needs prediction. In our view, 4 or 5 ms is already loose to accommodate the inference delay. |
| SPRD | N | We did not observe a strong motivation to introduce a new timeline for the AI-related P/SP report. |
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### **Others**

Qualcomm [20] proposed to revisit measurement restriction defined for aperiodic CSI reporting in case that periodic or semi-persistent RS for channel measurement is used. However, by the definition of Z’, d’ is already taken into account in TS38.214 Clause 5.4.

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| Company | Comments |
| FL | Please share your comments and suggestions, if any. |
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## 2.6 UE-side data collection

**Huawei**

**Proposal 3: For the configuration for training data collection of UE-side model for BM-Case 2, gNB indicates the preferred future time instance information as guidance to facilitate UE side training, including:**

* **TimeGap-r19, i.e., the time gap between two consecutive predicted time instances and between the reference time and the earliest predicted time instance.**
* **nroftimeinstance-r19, i.e., number of predicted time instances for BM-Case 2.**

**Lenovo**

**Proposal 2: Adopt the following CR for TS38.214V19.0.0**

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| 5.2.1.4.2 Report quantity configurations A UE may be configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to either 'none', 'cri-RI-PMI-CQI ', 'cri-RI-i1', 'cri-RI-i1-CQI', 'cri-RI-CQI', 'cri-RSRP', 'cri-SINR', 'ssb-Index-RSRP', 'ssb-Index-SINR', 'cri-RI-LI-PMI-CQI', 'cri-RSRP- Index', 'ssb-Index-RSRP- Index', 'cri-SINR- Index', 'ssb-Index-SINR- Index', 'tdcp', 'cli-SRS-RSRP', 'cli-RSSI', 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', 'p-ssb-index-RSRP-r19', 'rs-pai-r19', 'csi-pai-r19', 'none-csi-r19', 'none-bm-r19', 'cjtc-Dd', 'cjtc-F', 'cjtc-Dd-F' or 'cjtc-P'.  If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'none', 'none-csi-r19' or 'none-bm-r19', then the UE shall not report any quantity for the *CSI-ReportConfig*.  If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to'none-bm-r19', the physical layer in the UE measures the L1-RSRPs of the resources in the first and the second Resource Settings and provides the measurement results to the higher layers. |

**DOCOMO**

**Proposal 1. Introduce a new CSI priority factor to make the CSI report for UE-side data collection having a lower priority than the ones with actual CSI reports.**

----------Text proposal for Section 5.2.5 TS 38.214----------

CSI reports are associated with a priority value where

- m = 1 for CSI reporting with *CSI-ReportConfig* with *reportQuantity* set to ‘none-CSI-r19’ or ‘none-BM-r19’, and m = 0 otherwise.

-  for CSI reporting with *CSI-ReportConfig* with *eventType* and with *reportTransmissionMode* set to ‘ModeA’, *y* =1 for aperiodic CSI reports to be carried on PUSCH, *y* = 2 for CSI reporting with *CSI-ReportConfig* with *eventType* and with *reportTransmissionMode* set to ‘ModeB’,*y* = 3 for semi-persistent CSI reports to be carried on PUSCH, *y* = 4 for semi-persistent CSI reports to be carried on PUCCH and *y* = 5 for periodic CSI reports to be carried on PUCCH;

-  for CSI reports carrying L1-RSRP, P-CRI, P-SSBRI, P-L1-RSRP, RS-PAI or L1-SINR and  for CSI reports not carrying L1-RSRP, P-CRI, P-SSBRI, P-L1-RSRP, RS-PAI or L1-SINR;

- *c* is the serving cell index and is the value of the higher layer parameter *maxNrofServingCells*;

- for a CSI report configured with *ltm-CSI-ReportConfig*, *c* is the serving cell index value where the report configuration is configured.

- *s* is the *reportConfigID* andis the value of the higher layer parameter *maxNrofCSI-ReportConfigurations.*

- for a CSI report configured with *ltm-CSI-ReportConfig*, *s* is the *ltm-CSI-ReportConfigId* and *Ms* is the value of the higher layer parameter *maxNrofLTM-CSI-ReportConfigurations*

----------Text proposal ends--------------------------------------

Based on the summary above, issues and corresponding proposals are provided as follows.

### **Issue 2.6.1# Additional RRC parameter to facilitate UE-side data collection for BM-Case2**

HW [1] proposed additional RRC parameter to facilitate UE-side data collection for BM-Case2.

##### **Proposal. 2.6.1**

Support the configuration of following parameters in a *CSI-ReportConfig* with the higher layer parameter reportQuantity set to'none-bm-r19':

* TimeGap-r19, i.e., the time gap between two consecutive predicted time instances and between the reference time and the earliest predicted time instance.
* nroftimeinstance-r19, i.e., number of predicted time instances for BM-Case 2.

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comments |
| FL |  | Please share your view on the proposal. |
| Huawei, HiSilicon | Y | Support. With this information, UE side, when training the model, does not need blindly guess how many predicted time instances could be configured with how large gap in a later inference phase. Providing this information eases UE side training effort. |
| SPRD | N | It belongs to UE’s implementation. |
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### **Others**

Lenovo [16] proposed a TP for physical layer to pass L1 measurement results of UE-side data collection to higher layer. However, the associated description is typically described in 38.321 which can be discussed in RAN2.

DOCOMO [22] proposed a TP to address the CSI priority value for CSI reporting for data collection. However, it is natural that the priority should follow the same CSI priority as quantity with “none”.

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| Company | Comments |
| FL | Please suggest any other issue that need to be discussed, if any. |
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# Remaining issues for NW-side AI/ML model

## 3.1 CSI report for model inference

**Huawei**

**Table 1 Text proposal for RSRP mapping in case of M=size of measurement resource set for NW-side model inference**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 6.3.1.1.2-8G: Mapping order of CSI fields of one report for CRI/RSRP or SSBRI/RSRP reporting, if *nrofReportedRS* is configured**   |  |  | | --- | --- | | **CSI report number** | **CSI fields** | | CSI report #n | CRI or SSBRI #1 as in Table 6.3.1.1.2-6 | | CRI or SSBRI #2 as in Table 6.3.1.1.2-6, if reported | | … | | CRI or SSBRI # as in Table 6.3.1.1.2-6, if reported | | RSRP #1 as in Table 6.3.1.1.2-6 | | Differential RSRP #2 as in Table 6.3.1.1.2-6, if reported | | … | | Differential RSRP # as in Table 6.3.1.1.2-6, if reported | | NOTE: The value of is configured by the higher layer parameter *nrofReportedRS*. If the number of SSB/CSI-RS resources in the corresponding resource set for channel measurement, Differential RSRP #2,…, Differential RSRP #correspond to the 1,…,M-1 th SSB/CSI-RS resources of the resource set precluding CRI/SSBRI#1. | | |

**Proposal 9: Consider the text proposal in Table 1 for L1-RSRP mapping in case of M=size of measurement resource set for NW-side model inference in 38.212.**

**Google**

**Proposal 2: Support L1-RSRP report retransmission to facilitate the NW-side beam prediction for BM case 2**

**CATT**

**Summary of change:**

We propose to add the corresponding description of “with largest M measured value(s) of L1-RSRP(s) of a measurement resource set” in TS 38.214.

**Consequence if not approved:**

How to select the Top M beam(s) is not defined in TS 38.214, which is not aligned with the agreement.

**Proposal 1: For L1-RSRP reporting for NW-sided model, adopt the following TP:**

---------------------------------------------------------Start of TP for TS38.214---------------------------------------------

5.2.1.4.2 Report quantity configurations

<Unrelated part omitted>

If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-RSRP', 'ssb-Index-RSRP', 'cri-RSRP- Index' or 'ssb-Index-RSRP- Index',

- if the UE is configured with the higher layer parameter *groupBasedBeamReporting* set to 'disabled', the UE is not required to update measurements for more than 64 CSI-RS and/or SSB resources, and the UE shall report in a single report *nrofReportedRS* or *nrofReportedRS-r19* (higher layer configured) different CRI or SSBRI for each report setting where the *nrofReportedRS-r19* CRI or SSBRI are associated with the largest *nrofReportedRS-r19* L1-RSRPs of the measured of the measured CSI-RS resources or SS/PBCH block resources of the resource set, or single CRI or SSBRI for each report setting when *nrofReportedRS-r19* is equal to the size of the resource set for channel measurement where single CRI or SSBRI is associated with the largest L1-RSRP of the measured CSI-RS resources or SS/PBCH block resources of the resource set.

<Unrelated part omitted>

----------------------------------------------------------End of TP for TS38.214-----------------------------------------------

Table 1 Mapping order of CSI fields of one report for CRI/RSRP or SSBRI/RSRP reporting, if *nrofReportedRS* =the size of the measurement resource set

|  |  |
| --- | --- |
| **CSI report number** | **CSI fields** |
| CSI report #n | CRI or SSBRI #1 |
| RSRP #1 |
| Differential RSRP #2 |
| … |
| Differential RSRP # |
| NOTE:       The value of is configured by the higher layer parameter *nrofReportedRS*. | |

**Proposal 2: For NW-sided model, for inference, when M=the size of measurement resource set, the mapping ordering of differential RSRPs should be pre-defined to align gNB and UE’s understanding.**

* **The order can be based on the order of CRI/SSBRI values.**

**ZTE**

**Text Proposal 1: To adopt the following changes in section 6.3.1.1.2, TS38.212.**

**Summary of change**: For NW-sided model, for inference report, if the number of reported RSs is equal to the size of the resource set for channel measurement, clarify that except the largest L1-RSRP of the measured CSI-RS resources or SS/PBCH block resources of the resource set, all other L1-RSRPs shall be reported in descending order of CRI/SSBRI.

**Consequence if not approved**: The base station cannot correctly understand the CRI/SSBRI corresponding to each reported L1-RSRPs, and thus fails to perform model inference.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **6.3.1.1.2 CSI only**  <Unchanged part is omitted>  Table 6.3.1.1.2-8G: Mapping order of CSI fields of one report for CRI/RSRP or SSBRI/RSRP reporting, if *nrofReportedRS* is configured   |  |  | | --- | --- | | CSI report number | CSI fields | | CSI report #n | CRI or SSBRI #1 as in Table 6.3.1.1.2-6 | | CRI or SSBRI #2 as in Table 6.3.1.1.2-6, if reported | | … | | CRI or SSBRI # as in Table 6.3.1.1.2-6, if reported | | RSRP #1 as in Table 6.3.1.1.2-6 | | Differential RSRP #2 as in Table 6.3.1.1.2-6, if reported | | … | | Differential RSRP # as in Table 6.3.1.1.2-6, if reported | | NOTE: The value of is configured by the higher layer parameter *nrofReportedRS*. If M is equal to the size of the resource set for channel measurement, differential RSRP #n (n=2, 3, ... M) corresponds to the n-th smallest CRI/SSBRI among all other CRI/SSBRI except CRI/SSBRI#1. | |   <Unchanged part is omitted> |

**OPPO**

**Proposal 1. For BM-Case2 with NW-side model, support that UE reports multiple measurement instances of Set B in a single beam reporting instance.**

**Panasonic**

**Proposal 3: Group-based beam reporting can be enhanced to support to report more than 4 beams in one report for NW-sided model.**

**Proposal 4: For NW-sided model, for inference report, for BM-Case2, support content per measurement time instance in a beam report in L1 signaling as follows:**

* + **L1-RSRPs and corresponding beam information of Top M beam(s) with largest M measured value(s) of L1-RSRP(s) of a measurement resource set, where M is configured by gNB**
  + **If M<the size of measurement resource set, the beam information is CRI/SSBRI**
  + **If M = the size of the measurement resource set, the content is all L1-RSRPs and one beam index (i.e., CRI/SSBRI) for the largest measured value of L1-RSRPof a measurement resource set**
  + **Note: The purpose, such as above “for NW-sided model, for inference” will not be specified in RAN1 specifications**

**NEC**

Reason for change:

1. The follow agreement has not been reflected in the Table 6.3.1.1.2-8G in TS 38.212 [1], which causes the missing of conditions.

2. *nrofReportedRS* is not aligned with the parameter name *nrofReportedRS*-r19 used in TS 38.214 [2]

|  |
| --- |
| Agreement @ RAN1#117  For NW-sided model, for inference report, at least for BM-Case 1, the content in a beam report in L1 signaling, support   * L1-RSRPs and corresponding beam information of Top M beam(s) with largest M measured value(s) of L1-RSRP(s) of a measurement resource set, where M is configured by gNB * If M = the size of the measurement resource set, the content is all L1-RSRPs and one beam index (i.e., CRI/SSBRI) for the largest measured value of L1-RSRP of a measurement resource set |

Based on the agreement, we have the following text proposal.

**Proposal 3. Adopt the following TP to TS 38.212 V19.0.0.**

<Unchanged part omitted>

**Table 6.3.1.1.2-8G: Mapping order of CSI fields of one report for CRI/RSRP or SSBRI/RSRP reporting, if *nrofReportedRS-r19* is configured**

|  |  |
| --- | --- |
| **CSI report number** | **CSI fields** |
| CSI report #n | CRI or SSBRI #1 as in Table 6.3.1.1.2-6 |
| CRI or SSBRI #2 as in Table 6.3.1.1.2-6, if reported |
| … |
| CRI or SSBRI # as in Table 6.3.1.1.2-6, if reported |
| RSRP #1 as in Table 6.3.1.1.2-6 |
| Differential RSRP #2 as in Table 6.3.1.1.2-6, if reported |
| … |
| Differential RSRP # as in Table 6.3.1.1.2-6, if reported |
| NOTE: The value of is configured by the higher layer parameter *nrofReportedRS-r19*. If or , CRI or SSBRI #2, …, CRI or SSBRI # are not reported. | |

<Unchanged part omitted>

**CMCC**

**Proposal 2: Adopt the following Text Proposal in Clause 5.2.1.4.2 of TS 38.214 for inference report quantity:**

**Summary of change:**

Specify when UE reports in a single report *nrofReportedRS-r19* CRI or SSBRI for each report setting, *nrofReportedRS-r19* CRI or SSBRI is associated with the largest L1-RSRP of the measured CSI-RS resources or SS/PBCH block resources of the resource set.

**Consequence if not approved:**

UE determination on *nrofReportedRS-r19* CRI or SSBRI is up to UE implementation, which causes the misalignment between agreement and spec and the degradation on inference performance at NW side.

--------------------------- Start of Text Proposal for TS 38.214 -----------------------------

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-RSRP', 'ssb-Index-RSRP', 'cri-RSRP- Index' or 'ssb-Index-RSRP- Index',

- if the UE is configured with the higher layer parameter *groupBasedBeamReporting* set to 'disabled', the UE is not required to update measurements for more than 64 CSI-RS and/or SSB resources, and the UE shall report in a single report *nrofReportedRS* ~~or~~ *~~nrofReportedRS-r19~~* (higher layer configured) different CRI or SSBRI for each report setting, or *nrofReportedRS-r19* (higher layer configured) different CRI or SSBRI for each report setting when *nrofReportedRS-r19* is smaller than the size of the resource set for channel measurement where *nrofReportedRS-r19* CRI or SSBRI is associated with the largest L1-RSRP of the measured CSI-RS resources or SS/PBCH block resources of the resource set, or single CRI or SSBRI for each report setting when *nrofReportedRS-r19* is equal to the size of the resource set for channel measurement where single CRI or SSBRI is associated with the largest L1-RSRP of the measured CSI-RS resources or SS/PBCH block resources of the resource set

< Unchanged parts are omitted >

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

**Sharp**

**Proposal 1: Adopt the following TP#1 in TS 38.212 to clarify differential L1-RSRP values reported in the CSI report when the value of *M* configured by *nrofReportedRS* is equal to the size of the resource set for channel measurement.**

**Reason for change:** For NW side model for inference report, when the value of M configured by nrofReportedRs is equal to the size of the measurement resource set, M-1 differential RSRPs are reported. However, the corresponding beam information of the M-1 differential RSRPs is unclear.

**Summary of change:** Add relevant description to clarity thatM-1 differential RSRPs are placed in the CSI report according to the order of their corresponding resource locations in the resource set.

**Consequences if not approved:** Corresponding beam information for the reported M-1 differential RSRPs is not clear.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **TP#1**  **Table 6.3.1.1.2-8G: Mapping order of CSI fields of one report for CRI/RSRP or SSBRI/RSRP reporting, if *nrofReportedRS* is configured**   |  |  | | --- | --- | | **CSI report number** | **CSI fields** | | CSI report #n | CRI or SSBRI #1 as in Table 6.3.1.1.2-6 | | CRI or SSBRI #2 as in Table 6.3.1.1.2-6, if reported | | … | | CRI or SSBRI # as in Table 6.3.1.1.2-6, if reported | | RSRP #1 as in Table 6.3.1.1.2-6 | | Differential RSRP #2 as in Table 6.3.1.1.2-6, if reported | | … | | Differential RSRP # as in Table 6.3.1.1.2-6, if reported | | NOTE: The value of is configured by the higher layer parameter *nrofReportedRS*. If the value of is equal to the size of the resource set for channel measurement, differential RSRPs #2, …, #*M* are mapped according to the ascending order of their resource locations configured in the resource set. | | |

**Proposal 2:** Adopt the following TP#2 in TS 38.214 to clarify that the UE shall derive the CSI parameters other than CRI conditioned on the configured CSI-RS resources when the value of M configured by nrofReportedRS is equal to the size of the resource set for channel measurement.

**Reason for change:** For NW side model for inference report, when the value of M configured by nrofReportedRs is equal to the size of the measurement resource set, UE only reports one CRI and it is incorrect to specify that UE derives the CSI parameters other than CRI, i.e. (M-1) differential L1-RSRPs, conditioned on the reported CRI.

**Summary of change:** Further clarify that UE shall derive the CSI parameters other than CRI conditioned on the configured CSI-RS resources when the value of M configured by nrofReportedRS is equal to the size of the resource set for channel measurement.

**Consequences if not approved:** UE is unable to derive the (M-1) differential L1-RSRPs.

|  |
| --- |
| **TP#2**  5.2.1.4.2 Report quantity configurations  <unchanged parts are omitted>  Except for a *CSI-ReportConfig* configured with *reportQuantity* set to 'cri-RI-PMI-CQI' and *codebookType* set to 'typeII-CJT-r18', 'typeII-CJT-PortSelection-r18', 'typeII-Doppler-r18', or 'typeII-Doppler-PortSelection-r18', if the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-RSRP', 'cri-RSRP-Index', 'cri-RI-PMI-CQI ', 'cri-RI-i1', 'cri-RI-i1-CQI', 'cri-RI-CQI', 'cri-RI-LI-PMI-CQI', 'cri-SINR', or 'cri-SINR- Index ', and resources are configured in the corresponding resource set for channel measurement, then the UE shall derive the CSI parameters other than CRI conditioned on the *nrofReportedRS-r19* CSI-RS resources when *nrofReportedRS-r19* is configured and equal to the size of the resource set for channel measurement, otherwise the UE shall derive the CSI parameters other than CRI conditioned on the reported CRI, where CRI *k* (*k* ≥ 0) corresponds to the configured (*k*+1)-th entry of associated *nzp-CSI-RS-Resources* in the corresponding *NZP-CSI-RS-ResourceSet* for channel measurement, and (*k*+1)-th entry of associated *csi-IM-Resource* in the corresponding *csi-IM-ResourceSet* (if configured) or (*k*+1)-th entry of associated *nzp-CSI-RS-Resources* in the corresponding *NZP-CSI-RS-ResourceSet* (if configured for *CSI-ReportConfig* with *reportQuantity* set to 'cri-SINR' or 'cri-SINR- Index ') for interference measurement. 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.  <unchanged parts are omitted> |

Based on the summary above, issues and corresponding proposals are provided as follows.

### **Issue 3.1.1# The clarification of the mapping between CRI/SSBRI and the corresponding RSRP**

In [1], HW proposed to add the description of the mapping between CRI/SSBRI and the corresponding RSRP in case of the number of reported RS is the same as the size of resources set for channel measurement. Similar proposal was provided by CATT [3], ZTE [6] and Sharp [21]. NEC also mentioned to clarify that CRI or SSBRI #2 to CRI or SSBRI #M are not reported in this case.

##### **Proposal. 3.1.1**

Adopt the following TP for 38.212.

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| **Table 6.3.1.1.2-8G: Mapping order of CSI fields of one report for CRI/RSRP or SSBRI/RSRP reporting, if *nrofReportedRS-r19* is configured**   |  |  | | --- | --- | | **CSI report number** | **CSI fields** | | CSI report #n | CRI or SSBRI #1 as in Table 6.3.1.1.2-6 | | CRI or SSBRI #2 as in Table 6.3.1.1.2-6, if reported | | … | | CRI or SSBRI # as in Table 6.3.1.1.2-6, if reported | | RSRP #1 as in Table 6.3.1.1.2-6 | | Differential RSRP #2 as in Table 6.3.1.1.2-6, if reported | | … | | Differential RSRP # as in Table 6.3.1.1.2-6, if reported | | NOTE: The value of is configured by the higher layer parameter *nrofReportedRS*. If is equal to the number of SSB/CSI-RS resources in the corresponding resource set for channel measurement, Differential RSRP #n, n= 2,…,M, correspond to the n-th SSB/CSI-RS resources in the resource set other than the resource corresponding to CRI/SSBRI#1, and CRI or SSBRI #n is not reported. | | |

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| --- | --- | --- |
| Company | Y/N | Comments |
| FL |  | Please check the text proposal which is based on the inputs from companies. |
| Huawei, Hisilicon |  | Support the text other than “, and CRI or SSBRI #n is not reported”, since “only CSI/SSBRI#1 is reported” has been captured in 38.214.  - if the UE is configured with the higher layer parameter *groupBasedBeamReporting* set to 'disabled', the UE is not required to update measurements for more than 64 CSI-RS and/or SSB resources, and the UE shall report in a single report *nrofReportedRS* or *nrofReportedRS-r19* (higher layer configured) different CRI or SSBRI for each report setting, or single CRI or SSBRI for each report setting when *nrofReportedRS-r19* is equal to the size of the resource set for channel measurement where single CRI or SSBRI is associated with the largest L1-RSRP of the measured CSI-RS resources or SS/PBCH block resources of the resource set |
| Xiaomi |  | Ok |
| SPRD |  | It is necessary to further clarify that "the n-th SSB/CSI-RS resources" are arranged in ascending order based on CRI/SSBRI. |
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### **Issue 3.1.2# The clarification of Top M beams in CSI report for inference**

CATT [3] and CMCC [18] proposed to clarify the top M beam in CSI report for inference. In addition, CMCC [18] proposed to clarify the condition for UE to report *nrofReportedRS-r19* RS in CSI report.

##### **Proposal. 3.1.2**

Adopt the following Text Proposal in Clause 5.2.1.4.2 of TS 38.214 for inference report quantity.

**Summary of change:** Specify when UE reports in a single report *nrofReportedRS-r19* CRI or SSBRI for each report setting, *nrofReportedRS-r19* CRI or SSBRI is associated with the largest L1-RSRP of the measured CSI-RS resources or SS/PBCH block resources of the resource set.

**Consequence if not approved:** UE determination on *nrofReportedRS-r19* CRI or SSBRI is up to UE implementation, which causes the misalignment between agreement and spec and the degradation on inference performance at NW side.

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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* with the higher layer parameter *reportQuantity* set to 'cri-RSRP', 'ssb-Index-RSRP', 'cri-RSRP- Index' or 'ssb-Index-RSRP- Index',  - if the UE is configured with the higher layer parameter *groupBasedBeamReporting* set to 'disabled', the UE is not required to update measurements for more than 64 CSI-RS and/or SSB resources, and the UE shall report in a single report *nrofReportedRS* ~~or~~ *~~nrofReportedRS-r19~~* (higher layer configured) different CRI or SSBRI for each report setting, or *nrofReportedRS-r19* (higher layer configured) different CRI or SSBRI for each report setting when *nrofReportedRS-r19* is smaller than the size of the resource set for channel measurement where *nrofReportedRS-r19* CRI or SSBRI is associated with the largest L1-RSRP of the measured CSI-RS resources or SS/PBCH block resources of the resource set, or single CRI or SSBRI for each report setting when *nrofReportedRS-r19* is equal to the size of the resource set for channel measurement where single CRI or SSBRI is associated with the largest L1-RSRP of the measured CSI-RS resources or SS/PBCH block resources of the resource set  < Unchanged parts are omitted > |

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| --- | --- | --- |
| Company | Y/N | Comments |
| FL |  | The proposal is based on the input from companies. |
| Huawei, HiSilicon |  | It seems we only need to add the condition of K<Set B size case?  - if the UE is configured with the higher layer parameter *groupBasedBeamReporting* set to 'disabled', the UE is not required to update measurements for more than 64 CSI-RS and/or SSB resources, and the UE shall report in a single report *nrofReportedRS* or *nrofReportedRS-r19* (higher layer configured) different CRI or SSBRI for each report setting when *nrofReportedRS-r19* is smaller than the size of the resource set for channel measurement, or single CRI or SSBRI for each report setting when *nrofReportedRS-r19* is equal to the size of the resource set for channel measurement where single CRI or SSBRI is associated with the largest L1-RSRP of the measured CSI-RS resources or SS/PBCH block resources of the resource set |
| Xiaomi |  | Ok |
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### **Others**

Google [2] proposed to support L1-RSRP report retransmission to facilitate the NW-side beam prediction for BM case 2.

OPPO [9] proposed that support that UE reports multiple measurement instances of Set B in a single beam reporting instance.

Sharp [21] proposed a TP for the clarification of CRI in case of the number of reported RS is the same as the size of the resource set for channel measurement.

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| Company | Comments |
| FL | Please suggest any other issue that need to be discussed, if any. |
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## 3.2 NW-side data collection via higher layer signaling

**Huawei**

**Proposal 2: For report of data collection in higher layer for NW-side model for BM-Case 1 and BM-Case 2, support the following two options:**

* **Opt 1: L1-RSRPs of all measured beams (Set A and Set B).**
* **Opt 2: L1-RSRPs of all measured beams in Set B, and Top-K beams based on the measured beams (beam index and L1-RSRP) in Set A.**
* **Note: Set A and Set B are only used for discussion purpose and does not necessarily known by UE.**

**CATT**

**Proposal 3: For content for data collection for training for NW-sided model via higher layer signaling, for both BM-Case1 and BM-Case2, for each per instance, support the following options:**

* **Opt 1: L1-RSRPs measured based on resource set(s) (for Set A and Set B) configured to UE**
* **Opt 2: L1-RSRPs measured based on resource set (s) (for Set B) configured to UE, and beam information of Top K measured based on resource set(s) (for Set A) configured to UE**
* **Differential L1-RSRP reporting is supported with legacy quantization steps and ranges.**

**OPPO**

**Proposal 3. For NW-side data collection for training, it is up to RAN1 to decide the reporting content for MDT-based data collection, and the following contents should be supported**

* **L1-RSRPs measurements of fixed Set B as model input**
* **Top-K L1-RSRP(s) and Top-1 CRI/SSBRI as labels**

**Proposal 4: For BM-Case2 with NW-side model, the temporal domain information of the collected data for training could be reported in an implicit manner, i.e. no explicit time stamps needed.**

**Proposal 5: Continue to discuss and achieve consensus in RAN1 on the content of data collection for NW-side data collection for training.**

**Panasonic**

**Proposal 1: For content of data collection for NW-sided model training via higher layer signaling, for both BM-Case 1 and BM-Case2, for each per instance, support L1-RSRPs measured based on one resource set (for Set A and Set B) configured to UE**

* **FFS: Details on reporting configuration**

**Proposal 2: NW-sided model inference, support to that a measurement window for the measurement resource set, wherein the measurement window can include a number of measurement instances that should be configured with the measurement resource set.**

**CMCC**

**Proposal 1: For BM-Case 1 and BM-Case 2, for NW-sided data collection (for training) via higher layer signaling (i.e., MDT in RRC), consider following,**

* **RSRPs measured at the UE based on one resource set or two sets (for Set A and Set B) configured to UE**
* **Support following as data content** 
  + **Opt 1: L1-RSRPs of all measured beams (in Set A and Set B)**
  + **Opt 2: L1-RSRPs of all measured beams in Set B, and beam index and L1-RSRP of Top-K beams based on the measured beams in Set A.**

Based on the summary above, issues and corresponding proposals are provided as follows.

### **Issue 3.2.1# Data collection via MDT**

For MDT based data collection, several companies [1,3,9,10,18] proposed to define the corresponding content of measurement results in RAN1.

##### **Proposal. 3.1.2**

For BM-Case1 and BM-Case2, for NW-sided data collection (for training) via higher layer signaling (i.e., MDT in RRC), consider following,

* RSRPs measured at the UE based on one resource set or two sets (for Set A and Set B) configured to UE
* Support following as data content
  + Opt 1: L1-RSRPs of all measured beams (Set A and Set B)
  + Opt 2: L1-RSRPs of all measured beams in Set B, and Top-K beams based on the measured beams (beam index and L1-RSRP) in Set A.
* Note: the measurement is assumed obtained with “best” or “Quasi-optimal” Rx as legacy
* Note: Set A and Set B are only used for discussion purpose and does not necessarily known by UE.
* Note: “for NW-sided data collection (for training) via higher layer signaling (i.e., MDT in RRC),” is only for discission purpose.

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| Company | Y/N | Comments |
| FL |  | This is the proposal based on the revised proposal in RAN1#121. |
| Huawei, HiSilicon | Y |  |
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## 3.3 Beam indication

**Huawei**

**Proposal 7: For indicating the P2 measurement of the predicted Top-K beams which may vary over time, to enable a unified framework for both UE-side model and NW-side model, NW configures K fixed CSI-RS resources, and indicate the QCL information (TCI-stateID) as part of the MAC CE or DCI, to each of the K CSI-RS resources.**

**Ofinno**

**Proposal 2**: **Endorse TP#3 in Annex C for P2 sweeping based on Top-K beams.**

**5.2.1.5.1 Aperiodic CSI Reporting/Aperiodic CSI-RS when the triggering PDCCH and the CSI-RS have the same numerology**

A trigger state is initiated using the *CSI request* field in DCI.

- When all the bits of *CSI request* field in DCI are set to zero, no CSI is requested.

- When the number of configured CSI triggering states in *CSI-AperiodicTriggerStateList* is greater than , where  is the number of bits in the DCI *CSI request* field, the UE receives a subselection indication, as described in clause 6.1.3.13 of [10, TS 38.321], used to map up to  trigger states to the codepoints of the *CSI request* field in DCI.  is configured by the higher layer parameter *reportTriggerSize* where . When the UE would transmit a PUCCH with HARQ-ACK information in slot *n* corresponding to the PDSCH carrying the subselection indication, the corresponding action in [10, TS 38.321] and UE assumption on the mapping of the selected CSI trigger state(s) to the codepoint(s) of DCI CSI request field shall be applied starting from the first slot that is after slot where ** is the SCS configuration for the PUCCH and is the subcarrier spacing configuration for with a value of 0 for frequency range 1 and for FR2-NTN, and is provided by *K-Mac* or if *K-Mac* is not provided..

- When the number of CSI triggering states in *CSI-AperiodicTriggerStateList* is less than or equal to , the *CSI request* field in DCI directly indicates the triggering state.

- For each aperiodic CSI-RS resource in a CSI-RS resource set associated with each CSI triggering state, the UE is indicated the quasi co-location configuration of quasi co-location RS source(s) and quasi co-location type(s), as described in clause 5.1.5, through higher layer signaling of *qcl-info* or *qcl-info2* which contains a list of references to *TCI-State's* for the aperiodic CSI-RS resources associated with the CSI triggering state. The UE is expected to be configured with *k* aperiodic CSI-RS resources in the CSI-RS resource set associated with a CSI triggering state without associated *qcl-info* and the UE assumes the *TCI-State* follows the most recently reported top *k* predicted TCI states. If a remaining aperiodic CSI-RS resource in the CSI-RS resource is configured with one of the TCI state for the top *k* predicted TCI states, the UE assumes the aperiodic CSI-RS resource is not transmitted. If a *TCI-State* referred toin the list is configured with a reference to an RS configured with *qcl-Type* set to 'typeD', that RS may be an SS/PBCH block located in the same or different CC/DL BWP or a CSI-RS resource configured as periodic or semi-persistent located in the same or different CC/DL BWP.

**OPPO**

**Proposal 2. For BM-Case2 with NW-side model, support that UE can be indicated with multiple TCI states for multiple future instances.**

**Proposal 8: For inference of BM-Case2 with UE-side model, support to indicate multiple TCI states for up to N future time instances with one-shot beam indication.**

**Panasonic**

**Proposal 5: For NW-sided model, support to extend Rel. 17 TCI state activation signaling methods to activate TCI states of *K* predicted beams for *N* future time instances in BM-Case 2.**

* **The TCI states of *K* predicted beams for *N* future time instances are included in a separate set of TCI states, compared to that of legacy BM.**

**Apple**

**Proposal 2-1: for Option B, the predicted beams in a CSI report is referred by NW through CSI report configuration ID.**

There is no enhancement agreed in previous meeting and hence it is not suggested to open the discussion in CR stage which is aiming for essential correction rather than optimization.

# UE Capability related issues

**Huawei**

**Proposal 1: For data collection for both NW-side model and UE-side model, support to extend the maxNrofNZP-CSI-RS-ResourcesPerSet (i.e., Maximum number of NZP CSI-RS resources per resource set) to 256, subject to UE capability.**

* **Note: UE support of maxNumberCSI-RS-Resource (max number of configured CSI-RS resources) needs to be enhanced to 256 accordingly.**

**ZTE**

**Text Proposal 2: To adopt the following changes in section 5.2.1.4.1, TS 38.214.**

**Summary of change:** For both NW-side model and UE-side model, extend the maximum number of NZP CSI-RS resources per resource set to 256.

**Consequence if not approved:** The base station has to configure multiple resource sets for supporting Set A larger than 64, and the UE has to integrate measurement results from the multiple resource sets, leading to additional configuration overhead and UE power consumption.

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| **5.2.1.4.1 Resource Setting configuration**  <Unchanged part is omitted>  A UE is not expected to be configured with more than one CSI-RS resource in resource set for channel measurement for a *CSI-ReportConfig* with the higher layer parameter *codebookType* set to 'typeII', 'typeII-PortSelection', 'typeII-r16', 'typeII-PortSelection-r16', or 'typeII-PortSelection-r17'. A UE is not expected to be configured with more than ~~64~~ 256 NZP CSI-RS resources and/or SS/PBCH block resources in resource setting for channel measurement for a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'none', 'cri-RI-CQI', 'cri-RSRP', 'ssb-Index-RSRP', 'cri-SINR' or 'ssb-Index-SINR', 'cri-RSRP- Index', 'ssb-Index-RSRP- Index', 'cri-SINR- Index', 'ssb-Index-SINR- Index', 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', 'p-ssb-index-RSRP-r19', 'rs-pai-r19', or 'none-bm-r19'. If interference measurement is performed on CSI-IM, each CSI-RS resource for channel measurement is resource-wise associated with a CSI-IM resource by the ordering of the CSI-RS resource and CSI-IM resource in the corresponding resource sets. The number of CSI-RS resources for channel measurement equals to the number of CSI-IM resources.  <Unchanged part is omitted> |

**Panasonic**

**Proposal 8: For both NW-side model and UE-side model, support a maximum number of NZP CSI-RS resources per resource set to 256 per CC, subject to UE capability.**

**Nokia**

**Proposal 6: For the counting of the active CSI-RS resources, endorse the following text proposal to 38.214 Clause 5.2.1.6.**

**Summary of change**: Given above points, in this text proposal we would aim to: i) address the challenges posed by the legacy rules for active CSI-RS resources in CSI reporting framework extended to AI/ML-related beam prediction and ii) eliminate inefficiencies in counting active NZP-CSI-RS resources to fully clarify the UE capabilities indication.

**Consequence if not approved:** Without this clarification, the gNB ability to utilize other CSI reports may be restricted by the presence of resources in Set A. Considering the Set A may include a large number of CSI-RS resources (e.g. up to 256) this limitation is significant.

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| **5.2.1.6 CSI processing criteria**  < Unchanged parts are omitted >  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 (excluding the case in which the corresponding aperiodic CSI Reporting Setting is configured with the higher layer parameter [RRC\_name-r19] and is linked to another aperiodic CSI Reporting Setting with reportQuantity-r19 set to 'csi-pai-r19' and the case in which corresponding aperiodic CSI-RS resources are only configured for reporting ‘p-CRI’ or ‘p-CRI-RSRP’), 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 aperiodic CSI-RS resources are for reporting ‘p-CRI’ or ‘p-CRI-RSRP’, the UE does not expect to assume aperiodic CSI-RS resources as active. When the PDCCH candidates are associated with a search space set configured with *searchSpaceLinkingId*, 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 ((excluding the case in which semi-persistent CSI-RS resources are only configured for reporting ‘p-CRI’ or ‘p-CRI-RSRP’), starting from the end of when the activation command is applied, and ending at the end of when the deactivation command is applied. The UE does not expect to receive an activation command for semi-persistent CSI-RS resource set if the CSI-RS resource set is only configured for reporting ‘p-CRI’ or ‘p-CRI-RSRP’. For periodic CSI-RS (excluding the case in which periodic CSI-RS resources are only configured for reporting ‘p-CRI’ or ‘p-CRI-RSRP’), starting when the periodic CSI-RS is configured by higher layer signalling, and ending when the periodic CSI-RS configuration is released. When the periodic CSI-RS resources are only for reporting ‘p-CRI’ or ‘p-CRI-RSRP’, the UE does not expect to assume periodic CSI-RS resources as active.  < Unchanged parts are omitted > |

**Ericsson**

**Proposal 4 RAN1 to agree that predicted CSI-Resources that are part of set A for inference are not considered as active.**

**Sharp**

**Proposal 9: Adopt the following TP#9 in TS 38.214 to clarify that only Set A is considered for determination of CPU occupation time for the model training CSI report.**

**Reason for change:** For model inference report, UE is not expected to measure the CSI-RS resources configured in Set A and the CSI-RS resources configured in Set A do not need to occupy the memory of the UE for processing CSI-RS resources.

**Summary of change:** Clarify that only Set A is considered for determination of CPU occupation time for the model training CSI report.

**Consequences if not approved:** CSI-RS resources configured in Set A occupy the memory for processing CSI-RS resources while UE does not expect to measure these resources.

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| **TP#9**  5.2.1.6 CSI processing criteria  <unchanged parts are omitted>  If a CSI-RS resource is referred *N* times by one or more CSI Reporting Settings not configured with higher layer parameter *csi-ReportSubConfigToAddModList*, 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-ReportConfig* containing a list of *L* sub-configuration(s) provided by higher layer parameter *csi-ReportSubConfigToAddModList,* 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 from *M* sub-configurations derived from the corresponding antenna port subset indicator *portSubsetIndicator* according to clause 5.2.1.4.2 if configured, otherwise .  For a *CSI-ReportConfig* with *reportQuantity* set to 'p-cri-r19', or 'p-cri-RSRP-r19', only CSI-RS resources of the first Resource Setting are referred and counted.  <unchanged parts are omitted> |

Based on the summary above, issues and corresponding proposals are provided as follows.

### **Issue 4.1# Max number of resources within a resource set**

Several companies [1,6,10] proposed to extend the maximum number of NZP CSI-RS resources per resource set to 256.

##### **Proposal. 4.1**

For both NW-side model and UE-side model only, for data collection

* support the maximum number of NZP CSI-RS resources per resource set to 256 per CC, subject to UE capability.
  + The number of maximum number of NZP CSI-RS resources per resource set across all CCs are kept the same as the one for non-AI.
* Note: This does not impact on non-AI CSI capability.

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| Company | Y/N | Comments |
| FL |  | This is the proposal based on the revised proposal in RAN1#121. |
| Huawei, HiSilicon |  | First, support the increased capability of up to 256 beams.  Second, it is not clear why we need to distinguish ‘AI’ and ‘non-AI’. In our view, NW side data collection is via MDT signaling, which is by natural different from legacy L1 reported signaling. From UE perspective, the capability of measured beam number for MDT reported method is separate from the capability of measured beam number for L1 reported method, that is enough, it does not need to know the purpose of data collection. |
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### **Issue 4.2# The counting of active resource**

Several companies [19,21] proposed to clarify the counting for resources in Set A for CSI report for inference. In FL’s understanding, the counting for beam management related resources are subject to two capabilities which are *maxTotalResourcesForOneFreqRange-r16* and *maxTotalResourcesForAcrossFreqRanges-r16*, respectively. Details including counting rules are listed below.

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| ***maxTotalResourcesForAcrossFreqRanges-r16***  Indicates the maximum total number of SSB/CSI-RS/CSI-IM resources for beam management, pathloss measurement, BFD, RLM and new beam identification across frequency ranges (both FR1 and FR2) that the UE supports.  The capability signalling includes the following:  - *maxNumberResWithinSlotAcrossCC-AcrossFR-r16* indicates maximum total number of SSB/CSI-RS/CSI-IM resources configured to measure within a slot across all CCs across all frequency ranges for any of L1-RSRP measurement, L1-SINR measurement, pathloss measurement, BFD, RLM and new beam identification.  - *maxNumberResAcrossCC-AcrossFR-r16* indicates maximum total number of SSB/CSI-RS/CSI-IM resources configured across all CCs across all frequency ranges for any of L1-RSRP measurement, L1-SINR measurement, pathloss measurement, BFD, RLM and new beam identification.  gNB takes into conjunction of this feature and the features *maxTotalResourcesForOneFreqRange-r16****,*** *beamManagementSSB-CSI-RS, maxNumberCSI-RS-BFD, maxNumberSSB-BFD* and *maxNumberCSI-RS-SSB-CBD* when configuring SSB/CSI-RS/CSI-IM resources for beam management, pathloss measurement, BFD, RLM and new beam identification across frequency ranges. The signalled values apply to the shortest slot duration defined in any FR(s) that are supported by the UE.  NOTE 1: The "configured to measure" RS is counted within the duration of a reference slot in which the corresponding reference signals are transmitted.  NOTE 2: Regarding the "configured to measure" RS counting  - (basic usage 1): If one resource is used for one or multiple of BFD/RLM, it is counted as one.  - (basic usage 2): If one resource is used for one or multiple of New Beam Identification/PL-RS/L1-RSRP, add 1.  - L1-RSRP measurement includes cases associated with reports with *reportQuantity* set to '*ssb-Index-RSRP*', '*cri-RSRP*' or with *reportQuantity* set to '*none*' and *CSI-RS-ResourceSet* with *trs-Info* not configured.  - If one resource is used for L1-SINR in addition to basic usage 1 & 2, add N if referred N times by one or more CSI Reporting settings with *reportQuantity-r16* = '*ssb-Index-SINR-r16*' or '*cri-SINR-r16*'. |

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| ***maxTotalResourcesForOneFreqRange-r16***  Indicates the maximum total number of SSB/CSI-RS/CSI-IM resources for beam management, pathloss measurement, BFD, RLM and new beam identification for one frequency range that the UE supports.  The capability signalling includes the following:  *- maxNumberResWithinSlotAcrossCC-OneFR-r16* indicates maximum total number of SSB/CSI-RS/CSI-IM resources configured to measure within a slot across all CCs in one frequency range for any of L1-RSRP measurement, L1-SINR measurement, pathloss measurement, BFD, RLM and new beam identification  *- maxNumberResAcrossCC-OneFR-r16* indicates maximum total number of SSB/CSI-RS/CSI-IM resources configured across all CCs in one frequency range for any of L1-RSRP measurement, L1-SINR measurement, pathloss measurement, BFD, RLM and new beam identification.  gNB takes into conjunction of this feature and the features *beamManagementSSB-CSI-RS, maxNumberCSI-RS-BFD, maxNumberSSB-BFD* and *maxNumberCSI-RS-SSB-CBD* when configuring SSB/CSI-RS/CSI-IM resources for beam management, pathloss measurement, BFD, RLM and new beam identification across one frequency range.  NOTE 1: The reference slot duration is the shortest slot duration defined for the reported FR supported by the UE.  NOTE 2: For RS configured for new beam identification, they are always counted regardless of beam failure event.  NOTE 3: The *maxNumberResWithinSlotAcrossCC-AcrossFR-r16* only counts those in active BWP but the *maxNumberResAcrossCC-AcrossFR-r16* counts all configured including both active and inactive BWP.  NOTE 4: The "configured to measure" RS is counted within the duration of a reference slot in which the corresponding reference signals are transmitted.  NOTE 5: Regarding the "configured to measure" RS counting  - (basic usage 1): If one resource is used for one or multiple of BFD/RLM, it is counted as one.  - (basic usage 2): If one resource is used for one or multiple of New Beam Identification/PL-RS/L1-RSRP, add 1.  - L1-RSRP measurement includes cases associated with reports with *reportQuantity* set to '*ssb-Index-RSRP*', '*cri-RSRP*' or with *reportQuantity* set to '*none*' and *CSI-RS-ResourceSet* with *trs-Info* not configured.  - If one resource is used for L1-SINR in addition to basic usage 1 & 2, add N if referred N times by one or more CSI Reporting settings with *reportQuantity-r16* = '*ssb-Index-SINR-r16*' or '*cri-SINR-r16*'. |

##### **Proposal. 4.2**

CSI-RS resource in set A for CSI report for inference are not counted.

* The counting is for *maxTotalResourcesForOneFreqRange-r16*, *maxTotalResourcesForAcrossFreqRanges-r16* in TS38.306

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| Company | Y/N | Comments |
| FL |  | The proposal is to clarify that CSI-RS resource in set A for CSI report for inference are not counted since it is not actually transmitted. For beam management, two capabilities are defined (*maxTotalResourcesForOneFreqRange-r16* and *maxTotalResourcesForAcrossFreqRanges-r16*) in TS38.306 for resource counting with counting rule (which are listed in the tables above). |
| Huawei, HiSilicon |  | Resource counting exemption part is OK.  But similar comment as Issue#2.1.6: how to handle the case if the same RS is also configured in another resource set which is actually transmitted? |
| Xiaomi |  | Suggest the updated one: CSI-RS resource only in set A for CSI report for inference are not counted. |
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### **Others**

Nokia [11] proposed to specify the duration time of active resource for CSI report for inference. However, the legacy texts in TS38.214 Clause 5.2.1.6 is only applicable to CSI acquisition and is not applicable to beam management. Hence, no change is needed for TS38.214.

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| Company | Comments |
| FL | Please suggest any other issue that need to be discussed, if any. |
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# Proposals for online

TBD

# References

1. R1-2505202 Maintenance of Rel-19 AI/ML for beam management Huawei, HiSilicon
2. R1-2505252 AI/ML based Beam Management Google
3. R1-2505312 Remaining issues on AI/ML-based beam management CATT
4. R1-2505367 Maintenance on specification support for beam management vivo
5. R1-2505425 Maintenance on AI/ML for beam management Xiaomi
6. R1-2505483 Discussion on maintenance of AI beam management ZTE Corporation, Sanechips
7. R1-2505530 Remaining issues on AI/ML based beam management Samsung
8. R1-2505657 Maintenance of AI beam management Ofinno
9. R1-2505731 On specification for AI/ML-based beam management OPPO
10. R1-2505785 Maintenance on AI/ML-based beam management Panasonic
11. R1-2505799 Maintenance on AI/ML Beam Management Nokia
12. R1-2505814 Maintenance on AI/ML for beam management LG Electronics
13. R1-2505872 Remaining issues in AI/ML enhancements for beam management Apple
14. R1-2505928 Remaining issues on specification support for beam management NEC
15. R1-2505958 Remaining issues on specification support for beam management Fujitsu
16. R1-2506044 Maintenance on AI/ML specification support for beam management Lenovo
17. R1-2506050 Discussion on specification support for beam management ETRI
18. R1-2506074 Maintenance of specification support for beam management CMCC
19. R1-2506168 Maintenance on Rel-19 AI/ML Beam Management Ericsson
20. R1-2506172 Specification support for AI-ML-based beam management Qualcomm Incorporated
21. R1-2506246 Remaining issues on specification support for beam management Sharp
22. R1-2506269 Maintenance on AI/ML for beam management NTT DOCOMO, INC.
23. R1-2506337 Discussion on AIML based beam management ASUSTeK

# Appendix A. Previous agreements

## RAN1#116

Agreement

For NW-sided model, for inference, in a beam report initiated by network, based on one measurement resource set, support the report of more than 4 beam related information in L1 signaling

* Note: Purpose, such as above “For NW-sided model, for inference”, will not be specified in RAN 1 specifications
* FFS on the report content for beam related information
* FFS on max number of reported beam related information in one report

Agreement

For UE-sided model, at least for BM-Case1, for content in the report of inference results, support

* Opt 1: Beam information on predicted Top K beam(s) among a set of beams
* Opt 2: Beam information on predicted Top K beam(s) among a set of beams and RSRP of predicted Top K beam(s) among a set of beams
* At least K=1 and more, FFS on max value
* FFS on beam information
* FFS on the definition of predicted Top K beam(s)
* FFS on definition of reported RSRP when applicable
* FFS on other information in the report with potential down selection among the following options
  + Opt 3: Beam information on predicted Top K beam(s) among a set of beams and probability information of predicted Top K beam(s) among a set of beams
    - FFS on the quantization method of probability information
    - Probability information is the probability of the beam to be the Top 1 or Top K beam
  + Opt 4: Beam information on predicted Top K beam(s) among a set of beams, RSRP of predicted Top K beam(s) among a set of beams, and confidence information of the RSRP
    - FFS on definition of reported RSRP
    - FFS on the definition and quantization method of confidence information
  + Other options are not precluded.

where the set of beams is Set A, i.e., the beams for UE prediction.

Agreement

* For NW-sided model and for UE-sided model, beam indication is based on unified TCI state framework
* FFS on whether/how potential enhancement is needed

Conclusion

For UE sided model at least for inference, for measurement, the configuration of Set B,

* take the current CSI framework as the starting point

## RAN1#116b

Agreement

For UE-side AI/ML model inference, for BM-Case2, support to report inference results of N(N>=1, FFS on N) future time instance(s) in one report

* wherein information of inference results of one time instance is as in one report for BM-Case 1
  + Note: overhead reduction is not precluded
* FFS on details

Agreement

For network-sided AI/ML model for BM-Case1 and BM-Case2,

* support using existing CSI framework for configuration of Set A as the starting point
* support using existing CSI framework for configuration of Set B as the starting point
* Note: Purpose, such as above “For NW-sided model, for BM-Case1 and BM-Case2” and “Set A” and “Set B”, will not be specified in RAN 1 specifications

Agreement

For report content of inference results for UE-sided model for BM-Case 1, for the RSRP ofpredicted Top K beam(s) in the report of inference results, when applicable, further study the following options:

* Option A: Predicted RSRP
* Option B: Predicted RSRP, if the beam is not configured for corresponding measurement, and measured L1-RSRP if the beam is configured for corresponding measurement
* Where the predicted RSRP is based on AI/ML output
* Note: Support both Option A and Option B is not precluded.

Working Assumption

For report content of inference results for UE-sided model for BM-Case 2, the RSRP ofpredicted beam(s) in the report of inference results, is the predicted RSRP, where the predicted RSRP is based on AI/ML output

Agreement

For UE-sided model at least for BM Case-1, *CSI-ReportConfig* is used for the configuration of inference results reporting

* FFS on the details in the *CSI-ReportConfig*, at least considering:
  + Alt 1: one *CSI-ResourceConfigId* is configured for Set B
    - FFS: how UE can determine the information about set A
  + Alt 2: one *CSI-ResourceConfigId* is configured for both Set A and Set B
    - FFS: How to configure resource set(s) for Set A and Set B in *CSI-ResourceConfig*
  + Alt 3: two *CSI-ResourceConfigId* s are configured for Set A and Set B separately
  + Alt 4: one *CSI-ResourceConfigId* is configured for Set B, Set A is configured using separate resource set(s) other than that represented by *CSI-ResourceConfigId*
    - FFS: how to configure/indicate separate resource set(s) for Set A
  + Note: separate *CSI-ReportConfig* for Set A and Set B are not precluded.
  + Note: Not perform measurement for Set A and only perform measurement for Set B subject to the *CSI-ReportConfig*
  + FFS on the association between Set A and Set B with or without additional IE
  + Other necessary configuration are not precluded.

Agreement

Further study, for the consistency of NW-side additional condition across training and inference for UE-sided model for BM-Case 1 and BM Case 2, where the NW-side additional condition may at least impact UE assumption on beams of Set A/Set B:

* Opt1: Based on associated ID (Referring to AI 9.1.3.3)
  + FFS on what can be assumed by UE with the same associated ID across training and inference
  + FFS on how associated ID is introduced, e.g., within CSI framework, or outside of CSI framework
* Opt 2: Performance monitoring based
  + FFS details
* Other options are not precluded.

## RAN1#117

Agreement

For BM-Case1 and BM-Case2 with a UE-side AI/ML model:

* Support Type 1 performance monitoring, including the following two options:
  + Option 1 (NW-side performance monitoring):
    - UE sends a report to NW (for the calculation of performance metric at NW)
      * Measurement results from resource set for monitoring, e.g., L1-RSRP and/or RS index is supported as the content of the report
      * FFS on other contents
    - The report is at least configured/triggered by NW
    - Note: this may or may not have additional spec impact
  + Option 2 (UE-assisted performance monitoring):
    - UE calculates performance metric(s)
      * FFS how to report and what to report
  + FFS whether to trigger the report based on event(s) for Option 1 and/or Option 2
* FFS Type 2 performance monitoring

Agreement

At least for NW sided model, for the quantization of a reported L1-RSRP value at least for the report in L1 signaling, support

* Support differential L1-RSRP reporting with legacy quantization step and range
  + FFS: larger quantization step(s) than the already supported legacy quantization step for differential L1-RSRP and/or for absolute L1-RSRP
  + FFS: Smaller range(s) for differential L1-RSRP than the already supported legacy range

Agreement

Following Working Assumption is confirmed.

Working Assumption

For report content of inference results for UE-sided model for BM-Case 2, the RSRP ofpredicted beam(s) in the report of inference results, is the predicted RSRP, where the predicted RSRP is based on AI/ML output.

Agreement

For NW-sided model, for inference report, at least for BM-Case 1, the content in a beam report in L1 signaling, support

* L1-RSRPs and corresponding beam information of Top M beam(s) with largest M measured value(s) of L1-RSRP(s) of a measurement resource set, where M is configured by gNB
* If M = the size of the measurement resource set, the content is all L1-RSRPs and one beam index (i.e., CRI/SSBRI) for the largest measured value of L1-RSRP of a measurement resource set
* FFS: L1-RSRPs and corresponding beam information of up to M beams within X dB gap to the largest measured value of L1-RSRP, X and M are configured by gNB, and whether/how to report number of reported beams
* FFS on the maximum value of M (where M can be larger than 4) based on UE capability (M may or may not be different for different reporting contents)
* FFS on beam information
* Note: Purpose, such as above “For NW-sided model, for inference report, at least for BM-Case 1”, will not be specified in RAN 1 specifications

## RAN1#118

Agreement

For UE sided model in beam management, ~~introduce~~ support associated ID

* [Working Assumption]
  + The associated ID at least can be configured within CSI framework
    - FFS on details
    - FFS on whether/how to configure/indicate the associated ID via other signal(s) and/or in other procedure(s)/framework(s)
* UE may assume the similar properties of a DL Tx beam or beam set/list associated with the same associated ID
  + FFS: whether/how to define *similar properties* of a DL Tx beam or beam set/list

Agreement

For UE-sided model, for the quantization of a RSRP value at least for the report of inference results, support

* Support differential RSRP reporting with legacy quantization step and range for L1-RSRP reporting
  + For BM-Case 1, support differential RSRP report among multiple beams
  + For BM-Case 2, support differential RSRP report among multiple beams over multiple time instances
    - FFS details

Agreement

For UE-sided model at least for BM Case-1, for inference results report

* Two resource sets can be configured for Set A and Set B separately in the CSI report configuration for the report
  + FFS whether support only resource set for Set B is configured
* UE performs measurement on the resource set for Set B for inference, and UE is not expected to measure resource set for Set A for inference,
* The beam information in the inference report refers to the resource set for Set A

Agreement

For BM-Case1 and BM-Case2 with a UE-sided AI/ML model, for Option 2 (UE-assisted performance monitoring), further study at least the following alternatives, including:

* Alt 1: Top 1 or Top K beam prediction accuracy (with or without margin) by comparing the prediction results and the Top 1 or Top K beam based on the measurements from a resource set/resources for monitoring
* Alt 2: The L1-RSRP difference information based on actual measurement of the L1-RSRP of one or more of Top K predicted beam, and L1-RSRP measurements from a resource set/resources for monitoring
* Alt 3: The RSRP difference information between the predicted RSRP and measured L1-RSRP of corresponding beam(s) of a resource set/resources for monitoring
  + Note: resources for Set B for monitoring are not precluded and can be study.
  + Note: this is only applicable when the model can predict RSRP
* Alt 4: The probability information of the predicted beam(s) to be the Top 1 or Top K beam
  + Note: this is only applicable when the model can generate probability information
* FFS: for Alt 1/2/3, on other details including how to configure the resource set/resources for monitoring, including
  + E.g. whether/how to use full set of Set A for measurement. If not, whether/how to obtain the measurement of the predicted Top 1 or Top K beam for calculating the prediction accuracy or the RSRP difference.
* For all alternatives, study whether the performance information is calculated per sample (one-shot), or per set of samples (window)

Agreement

For UE-sided model for BM-Case 2, for inference results report, support to configure UE with N future time instance(s) for inference by NW when applicable

* FFS: how to determinate reference time for the time instance(s)
* FFS: duration values of the N time instance(s) that can be predicted.

## RAN1#118bis

Agreement

Answer to Q2 in R1-2407604 as below:

|  |
| --- |
| RAN 1 did not have agreement on the content of NW-side additional condition. RAN1 agreed to support associated ID and it can be used to ensure the consistency of NW-side additional condition across training and inference for UE-sided model for BM-Case 1 and BM Case 2. UE may assume the similar properties of a DL Tx beam or beam set/list associated with the same associated ID, while FFS whether/how to define similar properties of a DL Tx beam or beam set/list. |

Agreement

For BM-Case1 and BM-Case2 with a UE-sided AI/ML model, for Option 2 (UE-assisted performance monitoring),

* At least support Alt 1: Top 1 or Top K beam prediction accuracy (with or without margin) by comparing the prediction results and the Top 1 or Top K beam based on the measurements from a resource set/ resources for monitoring
  + FFS on detail definition of the metric, including whether/how to configure or define a window for calculation
  + FFS: on other details including how to configure the resource set/resources for monitoring, including
    - E.g. whether/how to use full set of Set A for measurement. If the full set A is not configured, whether/how to define the metric
* FFS other alternatives

Agreement

For BM-Case 2 of UE-side model, for the reference time of the earliest time instance for the predicted results, consider at least the following alternatives for potential down-selection:

* Option 1: Based on the uplink slot for the report
* Option 2: Based on the CSI reference resource corresponding to the report
* Option 3: Based on the latest transmission occasion of the CSI-RS/SSB resource in Set B for measurement for the report, wherein the transmission occasion is no later than the CSI reference resource

Agreement

For UE-side model, existing CPU mechanism is used as a starting point for AI/ML-based CSI processing.

* FFS whether the overall CPU should be shared or separately counted between legacy CSI reporting and AI/ML-based CSI reporting, and among AI/ML features/functionalities.
* FFS whether it is fully applicable for BM-Case 1 and/or BM-Case 2

Agreement

For UE-side AI/ML model, for BM-Case1, at least for inference, at least for Set B, support the following CSI-RS resource types for CMR:

* Periodic (P) CSI-RS
* Semi-persistent (SP) CSI-RS
* Aperiodic (AP) CSI-RS

For UE-side AI/ML model, for BM-Case 2, at least for inference, at least for Set B, support the following CSI-RS resource types for CMR:

* Periodic (P) CSI-RS
* Semi-persistent (SP) CSI-RS
* FFS: Aperiodic (AP) CSI-RS

Note: above CSI-RS resource refers to that used for beam management.

Agreement

At least for the monitoring Type 1 Option 2 of UE-side model monitoring (when applicable), consider the following options with potential down selection for the configuration for monitoring:

* Option 1: The resource set(s) for monitoring and report configuration for monitoring are configured (when applicable) within CSI report configuration used for inference
  + FFS: the resource set(s) for monitoring
  + UE measures the resource set(s) for monitoring.
  + FFS how/when to report the monitoring results.
* Option 2: Dedicated resource set(s) for monitoring and report configuration for monitoring are configured in a dedicated CSI report configuration used for monitoring
  + The dedicated report configuration used for monitoring links to an inference report configuration
    - FFS how to identify the connection between RSs in the resource set(s) for monitoring and Set A beams
  + UE measures the resource set(s) for monitoring.
  + FFS when to report the monitoring results.

Agreement

RAN 1 further study the following options for applicability for inference for UE-side model:

Option 1:

* In Step 3, following configurations are provided from NW to UE:
  + 1) UE is allowed to do UAI reporting via *OtherConfig,*
  + 2)+3) NW configures one or more *CSI-ReportConfig* for inference configuration, where the associated ID may be configured in CSI framework as working assumption applied.
  + FFS on whether some IEs in the CSI report configuration can be removed or modified
  + Note: CSI report configuration for UE-side model inference can’t be activated immediately upon receiving Step 3
* In Step 4, UE reports applicability(ies) of the above *CSI-ReportConfi*g
  + FFS on one or more of the above *CSI-ReportConfig* to be reported
* FFS on activation (including when/how) of inference report after obtaining the applicability from UE Step 4
* FFS: whether Step 5 is needed,

Option 2:

* In Step 3, following configurations are provided from NW to UE:
  + UE is allowed to do UAI reporting via *OtherConfig,*
  + NW configures one set or multiple sets of inference related parameters
    - Note: the set of inference related parameters is not configured by *CSI-ReportConfig*
    - FFS on the set of inference related parameters, at least including:
      * Set A related information
      * Set B related information
      * Report content related information
      * For BM-Case 2,
        + Time instances related information for measurements
        + Time instances related information for prediction
  + The associated ID(s) may be configured
    - wherein the associated ID(s) may be
      * FFS: a) part of one set of the inference related parameters, or
      * FFS: b) independently from the one set of the inference related parameters.
* In Step 4, UE reports applicability of the above one or multiple sets of inference related parameters, where the associated ID information may be associated.
* In Step 5, NW configures configuration(s) for CSI report for inference

Option 3:

* In Step 3, following configurations are provided from NW to UE:
  + 1) UE is allowed to do UAI reporting via *OtherConfig,*
  + 2) The associated ID(s) may be provided to UE, e.g., a new RRC parameter.
* In Step 4, UE reports by UAI
  + the applicable one or multiple sets of inference related parameters may be included.
    - FFS on the set of inference related parameters, at least including:
      * Set A related information
      * Set B related information
      * Report content related information
      * For BM-Case 2,
        + Time instances related information for measurements
        + Time instances related information for prediction
    - Note: not applicable may also be replied by UE
    - Note: if the inference related parameters are not supported for reporting, only the applicability(ies) or not is reported in Step 4.
  + the associated ID(s) may be included
    - FFS: a) as part of the inference related parameters, or
    - FFS: b) independently from the set of the inference related parameters.
* In Step 5, NW configures configuration(s) for CSI report for inference.

Note: There is no impact of configuring CSI report configuration for non-AI beam management in *RRCReconfiguration.*

Agreement

For UE-side model, for beam management, for inference report, support periodic CSI report, aperiodic CSI report, and semi-persistent CSI report.

Agreement

For beam management, multiple CSI reports for inference for UE-side model can be configured/activated/triggered, which is up to UE capability.

Agreement

Incorporating below text into the general part of the LS

In RAN1’s discussion of RAN 2 terminologies on beam management,

* The concept/terminology “functionality“ of **Supported functionalities** may refer to UE-capability information/parameters i.e., Rel-19 AI/ML-specific FGs
* The concept/terminology “ functionality“ of **Applicable functionalities** may refer to *CSI-ReportConfig* for inference configuration or a set of inference related parameters or information/parameters indicated by UE
* The **Activated functionalities** may be enabled based on CSI framework.

Therefore, the meaning and the granularity of “*functionality*“for **Applicable functionalities,** **Activated functionalities** and **Supported functionalities** may or may not be the same, depends on certain option in RAN1, and the discussion is still ongoing

Agreement

Answer to Q1 in R1-2407604 as below,

|  |
| --- |
| In Step 2, RAN1 expects that UE reports its UE-capability information/parameters, i.e., Rel-19 AI/ML-specific FGs (including components and corresponding value ranges). These AI/ML-specific UE capability information/parameters will depend on how FGs are defined including the granularity, that will be discussed in RAN1 later in the WI. |

## RAN1#119

Agreement

* For UE-sided model, at least for BM-Case 1, the beam information in inference result report is CRI/SSBRI of resource in Set A.

Conclusion

For BM-Case 2 of UE-side model, only fixed Set B across different time instance is supported for single CSI report.

Agreement

For both BM-Case 1 and BM-Case 2, for UE-sided model for inference, when Set A and Set B are configured within CSI report configuration,

* Two *CSI-ResourceConfigId* s are configured for Set A and Set B separately

Agreement

* In Step 3, following configurations are provided from NW to UE:
  + UE is allowed to do UAI reporting via *OtherConfig,*
  + The applicability report is based on A) and/or B)
    - It is up to RAN 2 to design the container
    - A) one or more of *CSI-ReportConfig* for inference configuration(wherein the associated ID may be configured in CSI framework as working assumption applied)
      * Note: CSI report configuration for UE-side model inference can’t be activated immediately upon receiving Step 3
    - B) One set or multiple sets of inference related parameters for applicability report only (not for inference)
      * It is up to RAN2 to design the container.
      * The set of inference related parameters selected from the IEs in/or the IEs referred by *CSI-ReportConfig* as a starting point, e.g.,
        + the associated ID

Note: this doesn’t imply the associated ID is mandatory

* + - * + Set A related information
        + Set B related information
        + Report content related information
        + For BM-Case 2,

Time instances related information for measurements

Time instances related information for prediction

* In Step 4, UE reports applicability for all the above A) one or more *CSI-ReportConfig*and/or B) set(s) of inference related parameters
  + FFS on whether/what other information along with the applicability is needed
  + If A)is configured in Step 3,
    - Applicable aperiodic CSI Report and semi-persistent CSI report can be activated/triggered by NW after the applicability reported.
    - Applicable periodic CSI Report is considered as activated only if the applicability of the corresponding *CSI-ReportConfig*is reported in *RRCReconfigurationComplete.*
* In Step 5, NW can optionally configure *CSI-ReportConfig* for inference configuration in *RRCReconfiguration*, where the associated ID may be configured in CSI framework as working assumption applied.
  + Note: Step 5 may be optional if UE has already been configured with *CSI-ReportConfig* in Step 3

Agreement

At least for the monitoring Type 1 Option 2 of UE-side model monitoring (when applicable), support to reuse CSI framework for the configuration for monitoring result report in L1 signaling:

* Dedicated resource set(s) for monitoring and report configuration for monitoring are configured in a dedicated CSI report configuration used for monitoring
  + The ID of an inference report configuration is configured in the configuration for monitoring to link the inference report configuration and monitoring report configuration
    - FFS how to identify the connection between RSs in the resource set(s) for monitoring and Set A beams
  + FFS on whether to support all the combination on time domain behavior of the *reportConfigType* for infernece report and the *reportConfigType* for monitoring report
  + FFS on the timing related issues
  + UE measures the dedicated resource set(s) for monitoring.

Conclusion

For the *CSI-ReportConfig* for inference configuration provided in Step 5,

* aperiodic CSI Report and semi-persistent CSI report can be activated/triggered by NW after *RRCReconfigurationComplete*.
* periodic CSI Report is considered as activated after *RRCReconfigurationComplete*.
* Note: UE is not expected to be configured with a *CSI-ReportConfig* for inference configuration for a non-applicable set of inference parameters or a non-applicable *CSI-ReportConfig*
  + Any specification impact is a separate discussion

## RAN1#120

Agreement

For report content of inference results for UE-sided model, where the largest RSRP value is quantized to a 7-bit value in the range [-140, -44] dBm with 1dB step size, and the differential RSRP is quantized to a 4-bit value with 2 dB step size.

Note: the model output is UE implementation and it doesn’t have to be RSRP subject to dBm value.

Agreement

For report content of inference results for UE-sided model for BM-Case 1, the RSRP of predicted beam(s)in the report of inference results, is the predicted RSRP, where the predicted RSRP is based on AI/ML output.

Note: how to capture it in the spec is a separate discussion.

Agreement

For UE-side AI/ML model inference and BM-Case2, for the quantization of a RSRP value of inference results in a report over multiple future time instances,

* the largest RSRP value based on prediction of all time instances is the reference RSRP, and differential RSRPs in the report are computed relative to the reference RSRP.
  + The time instance information of the beam with the largest RSRP are additionally indicated in the report.

Agreement

For inference, for BM-Case 2 of UE-side model,

* The time gap between two consecutive future time instances is configured by RRC, and the number of future time instance(s) *N* is configured by RRC.
  + time gap is [10ms, 20ms, 40ms, 80ms, 160ms]
  + N = [1, 2, 4, 8]
* Reference time of the earliest time instance for the predicted results is based on the most recent occasion of the CSI-RS/SSB resource in Set B for measurement
  + Where the most recent occasion of the CSI-RS/SSB resource of set B is the latest CSI-RS/SSB occasion no later than the corresponding CSI reference resource of the corresponding inference report.

Agreement

For UE-sided model, for configuring the resource for data collection purpose, support

* *CSI-ReportConfig* can used for configuring the resources for data collection purpose without CSI report.
  + One *CSI-ResourceConfigId* is configured for Set A.
  + One *CSI-ResourceConfigId* is configured for Set B.
  + Note: UE performs measurement on all resources
  + One or two associated IDs can be configured in *CSI-ReportConfig*
    - When Set B is equal or a subset of set A (i.e., *NZP-CSI-RS-ResourceId*/*SSB-Index* in the resource setfor Set B is within the *NZP-CSI-RS-ResourceId*/*SSB-Index* in the resource setfor Set A), one associated ID is configured,
    - Otherwise, one associated ID is configured for Set A and another one associated ID is configured for Set B
* FFS: whether/how to support 'aperiodic' CSI RS

Note: This is not related to whether/how to support delivery/transmission of the collected data for training for UE-sided model.

Agreement

For UE-sided model, in *CSI-ReportConfig* for inference

* One or two associated IDs can be configured in *CSI-ReportConfig*
  + When Set B is equal or a subset of set A (i.e., *NZP-CSI-RS-ResourceId*/*SSB-Index* in the resource setfor Set B is within the *NZP-CSI-RS-ResourceId*/*SSB-Index* in the resource setfor Set A), one associated ID is configured,
  + Otherwise, one associated ID is configured for Set A and another one associated ID is configured for Set B
* FFS: At least BM-Case 1, the applicability for 'aperiodic' CSI RS

## RAN1#120b

Agreement

For UE-sided model, regarding the resource type for data collection purpose, only always-on SSB and P/SP CSI-RS are supported.

Agreement

For BM-Case1, for the Top K beam(s) report as the inference results

* K is configured in inference report configuration to the UE.

Agreement

For UE-sided model inference, support the following report format (i.e., CSI field mapping order) for BM-Case1, for beam information on predicted Top K beam(s) among a set of beams and RSRP of predicted Top K beam(s) among a set of beams

|  |
| --- |
| CRI or SSBRI #1 |
| CRI or SSBRI #2 |
| … |
| CRI or SSBRI #K |
| RSRP #1 |
| differential RSRP #2 |
| … |
| differential RSRP #K |

* CRI or SSBRI #k is mapped to RSRP #k, where k = 1,2,…,K
* RSRP #1 is absolute predicted RSRP
* Differential RSRP #2~#K are differential predicted RSRP with reference to the largest predicted RSRP corresponding to CRI or SSBRI #1

Agreement

For UE-sided model inference, support the following report format (i.e., CSI field mapping order) for BM-Case2, for beam information on predicted Top K beam(s) among a set of beams and RSRP of predicted Top K beam(s) among a set of beams

|  |
| --- |
| Time instance indicator |
| CRI or SSBRI #1 of time instance #1 |
| CRI or SSBRI #2 of time instance #1 |
| … |
| CRI or SSBRI #K of time instance #1 |
| CRI or SSBRI #1 of time instance #2 |
| CRI or SSBRI #2 of time instance #2 |
| … |
| CRI or SSBRI #K of time instance #2 |
| … |
| CRI or SSBRI #1 of time instance #N |
| CRI or SSBRI #2 of time instance #N |
| … |
| CRI or SSBRI #K of time instance #N |
| RSRP #1 of time instance #1 |
| Differential RSRP #2 of time instance #1 |
| … |
| Differential RSRP #K of time instance #1 |
| Differential RSRP #1 of time instance #2 |
| Differential RSRP #2 of time instance #2 |
| … |
| Differential RSRP #K of time instance #2 |
| … |
| Differential RSRP #1 of time instance #N |
| Differential RSRP #2 of time instance #N |
| … |
| Differential RSRP #K of time instance #N |

* + Time instance indicator exist if N > 1
  + The size of CSI field for time instance indicator is
  + The value of time instance indicator n (n≥0) corresponds to the (n+1)-th earliest time instance in the N time instances
  + Time instance #1 corresponds to the time instance indicated by the time instance indicator
  + Time instance #2~#N are mapped to the remaining N-1 time instance(s) other than time instance #1 based on the time domain order of the time instances
    - where time instance #2 is mapped to the earliest time instance from the N-1 time instance(s)
  + CRI or SSBRI #k is mapped to RSRP #k with the same time instance, where k = 1,2,…,K
  + RSRP #1 of time instance #1 is absolute RSRP; and the remaining RSRP are differential RSRP with reference to the largest predicted RSRP corresponding to CRI or SSBRI #1 of time instance #1

Agreement

For BM-Case 2 of UE-side model, one RRC parameter represents the time gap configured for between two consecutive future time instances, and also represents the time gap between the reference time and the first future time instance for prediction.

Agreement

For UE-sided model monitoring Type 1 option 2, regarding the type of resource for the set for monitoring, support at least periodic CSI-RS, semi-persistent CSI-RS and SSB

Agreement

For UE-sided model monitoring Type 1 option 2, support the following combination for inference report type and monitoring report type:

|  |  |  |  |
| --- | --- | --- | --- |
| Monitoring report type  Inference report type | P report | SP report | AP report |
| AP report | Not support | Not support | Support |
| SP report | Not support | Support | Support |
| P report | Support | Support | Support |

Agreement

For UE-sided model, regarding a CSI report corresponding to *CSI-ReportConfig* for Type 1 option 2 monitoring, .

Note: the occupation duration is a separate discussion.

Agreement

For UE-sided AI/ML model for beam management, for Option 2 (UE-assisted performance monitoring), the performance metric of Top 1 or Top K beam prediction accuracy is defined as:

* At least one of the Top M beam(s) of the resource set(s) for monitoring is among Top-K predicted beam(s) of Set A (e.g., linked to at least one of the Top-K predicted beam(s) of Set A based on certain rule or signalling)
  + Where K is the number of predicted beam(s) in the corresponding inference report per time instance
  + Where Top M beam(s) is the best M beam(s) based on L1-RSRP measurements of the resource set(s) for monitoring
  + M is configured by NW in CSI report configuration for monitoring
    - M= 1, 2
  + FFS: detailed rule or signalling

Agreement

For calculation the performance metric of Type 1 Option 2 performance monitoring for UE-sided model:

* + Support the size of a set for monitoring is the same as the size of Set A,
    - The n-th resource in the set for monitoring is linked to the n-th resource in Set A.
  + Support the size of a set for monitoring is smaller than the size of Set A

Working Assumption

At least for the monitoring Type 1 Option 2 of UE-side model monitoring, for calculation of metric for monitoring,

* for BM-Case 1, measurement result of a transmission occasion of the CSI-RS/SSB resources for monitoring is linked with an inference report, where the CSI reference resource of the corresponding inference report has the minimal slot offset to the transmission occasion of the CSI-RS/SSB resources for monitoring.
  + Wherein, the corresponding inference report, and the transmission occasion of the CSI-RS/SSB resources for monitoring are no later than the CSI reference resource corresponding to the CSI report for monitoring
  + FFS: whether to introduce a threshold X for the minimal slot offset, and whether it is optionally configured by RRC, where the minimal slot offset *k* is no larger than X; otherwise, the transmission occasion for monitoring has no linked inference report.

Working Assumption

For BM-Case 1, the beam prediction accuracy is calculated based on *N* latest transmission occasion(s) of monitoring resources with linked inference report no later than CSI reference resource corresponding to the CSI report for monitoring

* wherein *N* (N>=1) is configured in *CSI-ReportConfig*
* FFS on additional rule for counting *N* linked pair

For BM-Case 1, one resource set for monitoring is configured in one *CSI-ReportConfig* for monitoring.

Conclusion

For UE-sided model, for BM-Case 2, for inference, AP CSI-RS for Set B is not supported.

Agreement

* For UE-side model, for AI/ML based beam management for BM-Case 1 and BM-Case 2, for processing of a CSI report for inference, considering the following options for potential down selection:
  + Option 1: only dedicated AI/ML PU is occupied, is reported by UE.
    - And
  + Option 2: only legacy CPU is occupied, it is reported by UE.
  + Option 3: both dedicated AI/ML PU and legacy CPU are occupied, is reported by UE.
    - And

Note: The supported option by UE is reported by UE capability, if multiple options are supported.

* The total number of dedicated AI/ML PU for AI/ML is reported by UE capability.
  + Note: The total number of Use case specific dedicated AI/ML PU could be discussed separately.

Working Assumption

For BM-Case 2, at least support to report one beam prediction accuracy for one configured time instance, configured by one *CSI-ReportConfig* for monitoring,

* only one resource set is configured in the *CSI-ReportConfig*
* the one configured time instance (i.e. f-th time instance of the time instance in one inference report) for metric calculation is configured in the *CSI-ReportConfig* for monitoring
* FFS on whether to configure more than one time instance
* the performance metric of the f-th time instance is calculated based on *N* latest transmission occasion(s) of monitoring resource with linked time instance, no later than CSI reference resource corresponding to the CSI report for monitoring
* N (N>=1) is configured in the *CSI-ReportConfig*
* FFS on additional rule for counting *N* linked pair
* measurement result of a transmission occasion of the CSI-RS/SSB resources for monitoring is linked with the f-th time instance for prediction, where the f-th time instance has the minimal slot offset to the transmission occasion of the CSI-RS/SSB resources for monitoring.
  + Wherein, the corresponding inference reports, and the transmission occasions of the CSI-RS/SSB resources for monitoring, [FFS on the f-th time instances] are no later than the CSI reference resource corresponding to the CSI report for monitoring
  + FFS: whether to introduce a threshold X, and whether it is optionally configured by RRC, where the minimal slot offset *k* is no larger than X; otherwise, the transmission occasion for monitoring has no linked time instance

## RAN1#121

Agreement

For calculation the performance metric of Type 1 Option 2 performance monitoring for UE-sided model, when the size of the set for monitoring is smaller than the size of Set A,

* support the mapping of the resources in the set for monitoring to resources in Set A is configured via RRC, support
  + A X-bit bitmap with Y non-zero bits is configured by the RRC in CSI Report Config for monitoring, where X is the size of Set A and Y is the size of the set for monitoring
    - The x-th MSB of the bitmap corresponds to x-th resource in Set A
    - The y-th nonzero bit of the bitmap corresponds to the y-th entry of associated *nzp-CSI-RS-Resources* or *csi-SSB-ResourceList* in the set for monitoring, 1≤y≤Y

Agreement

At least for the monitoring Type 1 Option 2 of UE-side model monitoring, for calculation of metric for monitoring,

* for BM-Case 1, the measurement result of nth (n = 1,..,N) latest transmission occasion of the CSI-RS/SSB resources for monitoring is linked with an inference report, where the CSI reference resource of the corresponding inference report has the minimal slot offset to the nth transmission occasion of the CSI-RS/SSB resources for monitoring.
  + Wherein, the corresponding inference report, and the transmission occasion of the CSI-RS/SSB resources for monitoring are no later than the CSI reference resource corresponding to the CSI report for monitoring.
  + Predefines a threshold X = 64 for the minimal slot offset, ~~which is configured by RRC,~~ where the minimal slot offset *k* is no larger than X; otherwise, the transmission occasion for monitoring has no linked inference report.
* Note: CSI reference resource corresponding to the CSI report for monitoring and inference is determined based on legacy for all types (P/SP/AP) of CSI report carrying L1-RSRP, considering discussing associated timeline separately.

The associated working assumption made in RAN1#120b will not be confirmed.

Agreement

For data collection for UE-sided model, in CSI-report configuration, *reportQuantity* is set to “*none-BM-r19*”.

Agreement

For UE-sided model, for inference report for BM-Case2, a time instance for prediction is defined as a slot.

**Conclusion**

For NW sided model for L1-RSRP report in L1 signaling, legacy quantization steps and range are reused.

Agreement

For the determination of CSI report priority value of a CSI report for inference, the existing is reused.

* k = 0 for the CSI report for inference.

For the determination of CSI report priority value of a CSI report for monitoring, the existing is reused.

* k = 0 for the CSI report for monitoring.

Agreement

For UE-side model, for AI/ML based beam management for BM-Case 1 and BM-Case 2, for processing of a CSI report for inference,

* For PU occupancy, for the number of AI/ML PU (OAPU) and/or legacy CPU (OCPU) are occupied,
  + OAPU= 0 or X1/X2 is reported by UE in UE capability report for BM-Case 1 and BM-Case 2 respectively.
  + OCPU=0 or Y1/Y2 is reported by UE in UE capability report for BM-Case 1 and BM-Case 2 respectively.
  + Note: Detailed values of X1/X2 and Y1/Y2 can be further discussed in UE feature.
  + Note: Combination of OAPU= 0 and OCPU=0 is not allowed.
  + Note: if any of the unoccupied PU cannot satisfy the corresponding required PU by the CSI report, the CSI report will follow the legacy behavior of exceeding the CPU limit, neither of the PUs are occupied.

Agreement

For UE-sided model, regarding a CSI report with *CSI-ReportConfig* for inference for BM-Case1 and BM-Case 2, when applicable, extend legacy Z3/Z3’ to Z3+d/ Z3’+d’, where d and d’ are reported by UE per SCS for BM-Case 1 and BM-Case 2 respectively.

* Detailed values of d and d’ can be further discussed in UE feature.

Agreement

For UE-sided model, regarding a *CSI-ReportConfig* for data collection,

* Reuse the existing CPU occupation time for a CSI report with *CSI-ReportConfig* with *reportQuantity* set to 'none' and TRS-info not configured.

Agreement

For NW-sided model, for inference, when M<the size of measurement resource set, the beam information is CRI/SSBRI

Note: The purpose, such as above “For NW-sided model, for inference” will not be specified in RAN1 specifications.

Agreement

For UE-sided model, regarding a CSI report with *CSI-ReportConfig* for inference for BM-Case1,

* Rel-15 CPU occupation time is reused for CPU occupation time of the CSI report.
* Rel-15 CPU occupation time is reused for AI/ML PU occupation time of the CSI report.
* Note: this is applicable to all types of CSI reports (i.e., AP/SP/P CSI report).

Agreement

For beam prediction accuracy report for monitoring, the report quantity RS-PAIis (0 ≤≤ N)

* Where is the total count of accurate reference signal prediction instance(s) that meets the condition, among *N* latest transmission occasion(s) of monitoring resources that no later than CSI reference resource corresponding to the CSI report for monitoring
  + condition:
    - for the transmission occasion of monitoring resources, it has a linked inference report
    - at least one of the *nrofBestBeamforMonitoring-r19* identified CSI-RS resources, or SS/PBCH Block resources mapped to one of the *nrofreportedpredictedrs-r19* reported P-CRI(s) or P-SSBRI(s), of the linked report of the CSI Reporting Setting for inference
  + if this condition is met, the transmission occasion is counted as an accurate reference signal prediction instance; otherwise, it is not counted as an accurate reference signal prediction instance.
* Where *N* = 1, 3, 7, 15 is configured in *CSI-ReportConfig* the size of CSI field associated with the RS-PAIis

Agreement

For BM-Case 1, one resource set for monitoring is configured in one *CSI-ReportConfig* for monitoring.

Agreement

For BM-Case 2, at least support to report one beam prediction accuracy for one configured time instance, configured by one *CSI-ReportConfig* for monitoring,

* only one resource set is configured in the *CSI-ReportConfig*
* the one configured time instance (i.e. f-th time instance of the time instance in one inference report) for metric calculation is configured in the *CSI-ReportConfig* for monitoring
* the performance metric of the f-th time instance is calculated based on *N* latest transmission occasion(s) of monitoring resource, no later than CSI reference resource corresponding to the CSI report for monitoring
  + The measurement result of nth (n = 1,..,N) latest transmission occasion of the CSI-RS/SSB resources for monitoring is linked with the f-th time instance for prediction, where the f-th time instance has the minimal slot offset to the nth transmission occasion of the CSI-RS/SSB resources for monitoring.
    - Wherein, the corresponding inference reports, and the transmission occasions of the CSI-RS/SSB resources for monitoring, are no later than the CSI reference resource corresponding to the CSI report for monitoring.
    - Predefines a threshold X =64, where the minimal slot offset *k* is no larger than X; otherwise, the transmission occasion for monitoring has no linked time instance.
  + Note: CSI reference resource corresponding to the CSI report for monitoring is determined based on legacy for all types (P/SP/AP) of CSI report carrying L1-RSRP

The associated working assumption made in RAN1#120b will not be confirmed.

Agreement

For UE-sided model, for BM-Case 1 and BM-Case 2, for content in the report of inference results, for Opt 1 (only beam information of predicted Top K beam(s)), the ranking information of the predicted Top K beams for K > 1 is conveyed by the order of the beam information.

Agreement

For UE-sided model, regarding a CSI report with CSI-ReportConfig for inference for BM-Case2, for occupancy duration of CPU and APU, same occupation time for AI/ML PU and legacy CPU.

* If the CSI report is aperiodic, for AI/ML PU, and for CPU, Rel-15 CPU occupation time for AP CSI report is reused
* If the CSI report is semi-persistent or periodic,
  + From the 1st symbol of the latest CSI-RS/SSB transmission occasion no later than CSI reference resource, until the last symbol of the PUCCH/PUSCH carrying the report.

Agreement

For option B of applicability check, RAN 1 assumes that at least the following RRC parameters are to be reused:

* For both BM-Case 1 and BM-Case 2:
  + *associatedIDforSetA-r19, resourcesForSetA-r19, resourcesForChannelMeasurement, associatedIDforSetB-r19, reportQuantity-r19, reportConfigType, nrofreportedpredictedrs-r19*
* For BM-Case 2:
  + *TimeGap-r19, nroftimeinstance-r19,*
* Note: this doesn’t imply the associated ID is always present

# Appendix B. Topic specific agreements

## NW-side AI/ML model

Agreement (RAN1#116)

For NW-sided model, for inference, in a beam report initiated by network, based on one measurement resource set, support the report of more than 4 beam related information in L1 signaling

* Note: Purpose, such as above “For NW-sided model, for inference”, will not be specified in RAN 1 specifications
* ~~FFS on the report content for beam related information~~
* ~~FFS on max number of reported beam related information in one report~~

Agreement (RAN1#116bis)

For network-sided AI/ML model for BM-Case1 and BM-Case2,

* support using existing CSI framework for configuration of Set A as the starting point
* support using existing CSI framework for configuration of Set B as the starting point
* Note: Purpose, such as above "For NW-sided model, for BM-Case1 and BM-Case2" and "Set A" and "Set B", will not be specified in RAN 1 specifications

Agreement (RAN1#117)

At least for NW sided model, for the quantization of a reported L1-RSRP value at least for the report in L1 signaling, support

* Support differential L1-RSRP reporting with legacy quantization step and range
  + FFS: larger quantization step(s) than the already supported legacy quantization step for differential L1-RSRP and/or for absolute L1-RSRP
  + FFS: Smaller range(s) for differential L1-RSRP than the already supported legacy range

Agreement (RAN1#117)

For NW-sided model, for inference report, at least for BM-Case 1, the content in a beam report in L1 signaling, support

* L1-RSRPs and corresponding beam information of Top M beam(s) with largest M measured value(s) of L1-RSRP(s) of a measurement resource set, where M is configured by gNB
  + If M = the size of the measurement resource set, the content is all L1-RSRPs and one beam index (i.e., CRI/SSBRI) for the largest measured value of L1-RSRP of a measurement resource set
* FFS: L1-RSRPs and corresponding beam information of up to M beams within X dB gap to the largest measured value of L1-RSRP, X and M are configured by gNB, and whether/how to report number of reported beams
* FFS on the maximum value of M (where M can be larger than 4) based on UE capability (M may or may not be different for different reporting contents)
* FFS on beam information
* Note: Purpose, such as above “For NW-sided model, for inference report, at least for BM-Case 1”, will not be specified in RAN 1 specifications

Conclusion (RAN1#121)

* For NW sided model for L1-RSRP report in L1 signaling, legacy quantization steps and range are reused.

Agreement (RAN1#121)

For NW-sided model, for inference, when M<the size of measurement resource set, the beam information is CRI/SSBRI

Note: The purpose, such as above “For NW-sided model, for inference” will not be specified in RAN1 specifications.

Beam indication

Agreement (RAN1#116)

For NW-sided model and for UE-sided model, beam indication is based on unified TCI state framework

* FFS on whether/how potential enhancement is needed

## UE-side AI/ML model

Data collection

Agreement (RAN1#120)

For UE-sided model, for configuring the resource for data collection purpose, support

* *CSI-ReportConfig* can used for configuring the resources for data collection purpose without CSI report.
  + One *CSI-ResourceConfigId* is configured for Set A.
  + One *CSI-ResourceConfigId* is configured for Set B.
  + Note: UE performs measurement on all resources
  + One or two associated IDs can be configured in *CSI-ReportConfig*
    - When Set B is equal or a subset of set A (i.e., *NZP-CSI-RS-ResourceId*/*SSB-Index* in the resource setfor Set B is within the *NZP-CSI-RS-ResourceId*/*SSB-Index* in the resource setfor Set A), one associated ID is configured,
    - Otherwise, one associated ID is configured for Set A and another one associated ID is configured for Set B
* FFS: whether/how to support 'aperiodic' CSI RS

Note: This is not related to whether/how to support delivery/transmission of the collected data for training for UE-sided model.

Agreement (RAN1#120bis)

For UE-sided model, regarding the resource type for data collection purpose, only always-on SSB and P/SP CSI-RS are supported.

Agreement (RAN1#121)

For data collection for UE-sided model, in CSI-report configuration, *reportQuantity* is set to “*none-BM-r19*”

Inference (BM-Case1)

**Model consistency (Associated ID)**

Agreement (RAN1#116bis)

Further study, for the consistency of NW-side additional condition across training and inference for UE-sided model for BM-Case 1 and BM Case 2, where the NW-side additional condition may at least impact UE assumption on beams of Set A/Set B:

* Opt1: Based on associated ID (Referring to AI 9.1.3.3)
  + FFS on what can be assumed by UE with the same associated ID across training and inference
  + FFS on how associated ID is introduced, e.g., within CSI framework, or outside of CSI framework
* Opt 2: Performance monitoring based
  + FFS details
* Other options are not precluded.

Agreement (RAN1#118)

For UE sided model in beam management, support associated ID

* ~~[Working Assumption]~~
  + ~~The associated ID at least can be configured within CSI framework~~ 
    - ~~FFS on details~~
    - ~~FFS on whether/how to configure/indicate the associated ID via other signal(s) and/or in other procedure(s)/framework(s)~~
* UE may assume the similar properties of a DL Tx beam or beam set/list associated with the same associated ID
  + FFS: whether/how to define *similar properties* of a DL Tx beam or beam set/list

Agreement (RAN1#120)

For UE-sided model, in *CSI-ReportConfig* for inference

* One or two associated IDs can be configured in *CSI-ReportConfig*
  + When Set B is equal or a subset of set A (i.e., *NZP-CSI-RS-ResourceId*/*SSB-Index* in the resource setfor Set B is within the *NZP-CSI-RS-ResourceId*/*SSB-Index* in the resource setfor Set A), one associated ID is configured,
  + Otherwise, one associated ID is configured for Set A and another one associated ID is configured for Set B
* FFS: At least BM-Case 1, the applicability for 'aperiodic' CSI RS

**Resource/Reporting Configuration**

**Conclusion** (RAN1#116)

For UE sided model at least for inference, for measurement, the configuration of Set B,

* take the current CSI framework as the starting point

Agreement (RAN1#116bis)

For UE-sided model at least for BM Case-1, *CSI-ReportConfig* is used for the configuration of inference results reporting

* FFS on the details in the *CSI-ReportConfig*, at least considering:
  + ~~Alt 1: one~~ *~~CSI-ResourceConfigId~~* ~~is configured for Set B~~
    - ~~FFS: how UE can determine the information about set A~~
  + ~~Alt 2: one~~ *~~CSI-ResourceConfigId~~* ~~is configured for both Set A and Set B~~
    - ~~FFS: How to configure resource set(s) for Set A and Set B in~~ *~~CSI-ResourceConfig~~*
  + Alt 3: two *CSI-ResourceConfigId* s are configured for Set A and Set B separately
  + ~~Alt 4: one~~ *~~CSI-ResourceConfigId~~* ~~is configured for Set B, Set A is configured using separate resource set(s) other than that represented by~~ *~~CSI-ResourceConfigId~~*
    - ~~FFS: how to configure/indicate separate resource set(s) for Set A~~
  + ~~Note: separate~~ *~~CSI-ReportConfig~~* ~~for Set A and Set B are not precluded.~~
  + Note: Not perform measurement for Set A and only perform measurement for Set B subject to the *CSI-ReportConfig*
  + FFS on the association between Set A and Set B with or without additional IE
  + Other necessary configuration are not precluded.

Agreement (RAN1#118)

For UE-sided model at least for BM Case-1, for inference results report

* Two resource sets can be configured for Set A and Set B separately in the CSI report configuration for the report
  + FFS whether support only resource set for Set B is configured
* UE performs measurement on the resource set for Set B for inference, and UE is not expected to measure resource set for Set A for inference,
* The beam information in the inference report refers to the resource set for Set A

Agreement (RAN1#118bis)

For UE-side AI/ML model, for BM-Case1, at least for inference, at least for Set B, support the following CSI-RS resource types for CMR:

* Periodic (P) CSI-RS
* Semi-persistent (SP) CSI-RS
* Aperiodic (AP) CSI-RS

For UE-side AI/ML model, for BM-Case 2, at least for inference, at least for Set B, support the following CSI-RS resource types for CMR:

* Periodic (P) CSI-RS
* Semi-persistent (SP) CSI-RS
* FFS: Aperiodic (AP) CSI-RS

Note: above CSI-RS resource refers to that used for beam management.

Agreement (RAN1#118bis)

For UE-side model, for beam management, for inference report, support periodic CSI report, aperiodic CSI report, and semi-persistent CSI report.

Agreement (RAN1#118bis)

For beam management, multiple CSI reports for inference for UE-side model can be configured/activated/triggered, which is up to UE capability.

**Conclusion** (RAN1#119)

For BM-Case 2 of UE-side model, only fixed Set B across different time instance is supported for single CSI report.

Agreement (RAN1#119)

For both BM-Case 1 and BM-Case 2, for UE-sided model for inference, when Set A and Set B are configured within CSI report configuration,

* two *CSI-ResourceConfigId* s are configured for Set A and Set B separately.

**Report contents**

Agreement (RAN1#116)

For UE-sided model, at least for BM-Case1, for content in the report of inference results, support

* Opt 1: Beam information on predicted Top K beam(s) among a set of beams
* Opt 2: Beam information on predicted Top K beam(s) among a set of beams and RSRP of predicted Top K beam(s) among a set of beams
* At least K=1 and more, FFS on max value
* FFS on beam information
* FFS on the definition of predicted Top K beam(s)
* FFS on definition of reported RSRP when applicable
* FFS on other information in the report with potential down selection among the following options
  + Opt 3: Beam information on predicted Top K beam(s) among a set of beams and probability information of predicted Top K beam(s) among a set of beams
    - FFS on the quantization method of probability information
    - Probability information is the probability of the beam to be the Top 1 or Top K beam
  + Opt 4: Beam information on predicted Top K beam(s) among a set of beams, RSRP of predicted Top K beam(s) among a set of beams, and confidence information of the RSRP
    - FFS on definition of reported RSRP
    - FFS on the definition and quantization method of confidence information
  + Other options are not precluded.

where the set of beams is Set A, i.e., the beams for UE prediction.

Agreement (RAN1#116bis)

For report content of inference results for UE-sided model for BM-Case 1, for the RSRP ofpredicted Top K beam(s) in the report of inference results, when applicable, further study the following options:

* Option A: Predicted RSRP.
* ~~Option B: Predicted RSRP, if the beam is not configured for corresponding measurement, and measured L1-RSRP if the beam is configured for corresponding measurement.~~
* Where the predicted RSRP is based on AI/ML output.
* ~~Note: Support both Option A and Option B is not precluded.~~

~~Working Assumption (RAN1#116bis)~~

~~For report content of inference results for UE-sided model for BM-Case 2, the RSRP of~~~~predicted beam(s) in the report of inference results, is the predicted RSRP, where the predicted RSRP is based on AI/ML output.~~

Agreement (RAN1#117)

Following Working Assumption is confirmed.

Working Assumption

For report content of inference results for UE-sided model for BM-Case 2, the RSRP ofpredicted beam(s) in the report of inference results, is the predicted RSRP, where the predicted RSRP is based on AI/ML output.

Agreement (RAN1#119)

For UE-sided model, at least for BM-Case 1, the beam information in inference result report is CRI/SSBRI of resource in Set A.

Agreement (RAN1#120)

For report content of inference results for UE-sided model, where the largest RSRP value is quantized to a 7-bit value in the range [-140, -44] dBm with 1dB step size, and the differential RSRP is quantized to a 4-bit value with 2 dB step size.

Note: the model output is UE implementation and it doesn’t have to be RSRP subject to dBm value.

Agreement (RAN1#120)

For report content of inference results for UE-sided model for BM-Case 1, the RSRP of predicted beam(s)in the report of inference results, is the predicted RSRP, where the predicted RSRP is based on AI/ML output.

Note: how to capture it in the spec is a separate discussion.

Agreement (RAN1#120bis)

For BM-Case1, for the Top K beam(s) report as the inference results

* K is configured in inference report configuration to the UE.

Agreement (RAN1#120bis)

For UE-sided model inference, support the following report format (i.e., CSI field mapping order) for BM-Case1, for beam information on predicted Top K beam(s) among a set of beams and RSRP of predicted Top K beam(s) among a set of beams

|  |
| --- |
| CRI or SSBRI #1 |
| CRI or SSBRI #2 |
| … |
| CRI or SSBRI #K |
| RSRP #1 |
| differential RSRP #2 |
| … |
| differential RSRP #K |

* CRI or SSBRI #k is mapped to RSRP #k, where k = 1,2,…,K
* RSRP #1 is absolute predicted RSRP
* Differential RSRP #2~#K are differential predicted RSRP with reference to the largest predicted RSRP corresponding to CRI or SSBRI #1

Agreement (RAN1#121)

For UE-sided model, for BM-Case 1 and BM-Case 2, for content in the report of inference results, for Opt 1 (only beam information of predicted Top K beam(s)), the ranking information of the predicted Top K beams for K > 1 is conveyed by the order of the beam information.

Inference (BM-Case2)

Agreement (RAN1#116bis)

For UE-side AI/ML model inference, for BM-Case2, support to report inference results of N(N>=1, FFS on N) future time instance(s) in one report

* wherein information of inference results of one time instance is as in one report for BM-Case 1.
  + Note: overhead reduction is not precluded.
* FFS on details

Agreement (RAN1#118)

For UE-sided model, for the quantization of a RSRP value at least for the report of inference results, support

* Support differential RSRP reporting with legacy quantization step and range for L1-RSRP reporting
  + For BM-Case 1, support differential RSRP report among multiple beams
  + For BM-Case 2, support differential RSRP report among multiple beams over multiple time instances
    - FFS details

Agreement (RAN1#118)

For UE-sided model for BM-Case 2, for inference results report, support to configure UE with N future time instance(s) for inference by NW when applicable

* FFS: how to determinate reference time for the time instance(s)
* FFS: duration values of the N time instance(s) that can be predicted.

Agreement (RAN1#118bis)

For BM-Case 2 of UE-side model, for the reference time of the earliest time instance for the predicted results, consider *at least* the following alternatives for potential down-selection:

* Option 1: Based on the uplink slot for the report
* Option 2: Based on the CSI reference resource corresponding to the report
* Option 3: Based on the latest transmission occasion of the CSI-RS/SSB resource in Set B for measurement for the report, wherein the transmission occasion is no later than the CSI reference resource

Agreement (RAN1#120)

For UE-side AI/ML model inference and BM-Case2, for the quantization of a RSRP value of inference results in a report over multiple future time instances,

* the largest RSRP value based on prediction of all time instances is the reference RSRP, and differential RSRPs in the report are computed relative to the reference RSRP.
  + The time instance information of the beam with the largest RSRP are additionally indicated in the report.

Agreement (RAN1#120)

For inference, for BM-Case 2 of UE-side model,

* The time gap between two consecutive future time instances is configured by RRC, and the number of future time instance(s) *N* is configured by RRC.
  + time gap is [10ms, 20ms, 40ms, 80ms, 160ms]
  + N = [1, 2, 4, 8]
* Reference time of the earliest time instance for the predicted results is based on the most recent occasion of the CSI-RS/SSB resource in Set B for measurement
  + Where the most recent occasion of the CSI-RS/SSB resource of set B is the latest CSI-RS/SSB occasion no later than the corresponding CSI reference resource of the corresponding inference report.

Agreement (RAN1#120bis)

For BM-Case 2 of UE-side model, one RRC parameter represents the time gap configured for between two consecutive future time instances, and also represents the time gap between the reference time and the first future time instance for prediction.

Agreement (RAN1#120bis)

For UE-sided model inference, support the following report format (i.e., CSI field mapping order) for BM-Case2, for beam information on predicted Top K beam(s) among a set of beams and RSRP of predicted Top K beam(s) among a set of beams

|  |
| --- |
| Time instance indicator |
| CRI or SSBRI #1 of time instance #1 |
| CRI or SSBRI #2 of time instance #1 |
| … |
| CRI or SSBRI #K of time instance #1 |
| CRI or SSBRI #1 of time instance #2 |
| CRI or SSBRI #2 of time instance #2 |
| … |
| CRI or SSBRI #K of time instance #2 |
| … |
| CRI or SSBRI #1 of time instance #N |
| CRI or SSBRI #2 of time instance #N |
| … |
| CRI or SSBRI #K of time instance #N |
| RSRP #1 of time instance #1 |
| Differential RSRP #2 of time instance #1 |
| … |
| Differential RSRP #K of time instance #1 |
| Differential RSRP #1 of time instance #2 |
| Differential RSRP #2 of time instance #2 |
| … |
| Differential RSRP #K of time instance #2 |
| … |
| Differential RSRP #1 of time instance #N |
| Differential RSRP #2 of time instance #N |
| … |
| Differential RSRP #K of time instance #N |

* + Time instance indicator exist if N > 1
  + The size of CSI field for time instance indicator is
  + The value of time instance indicator n (n≥0) corresponds to the (n+1)-th earliest time instance in the N time instances
  + Time instance #1 corresponds to the time instance indicated by the time instance indicator
  + Time instance #2~#N are mapped to the remaining N-1 time instance(s) other than time instance #1 based on the time domain order of the time instances
    - where time instance #2 is mapped to the earliest time instance from the N-1 time instance(s)
  + CRI or SSBRI #k is mapped to RSRP #k with the same time instance, where k = 1,2,…,K
  + RSRP #1 of time instance #1 is absolute RSRP; and the remaining RSRP are differential RSRP with reference to the largest predicted RSRP corresponding to CRI or SSBRI #1 of time instance #1

Conclusion (RAN1#120bis)

For UE-sided model, for BM-Case 2, for inference, AP CSI-RS for Set B is not supported.

Agreement (RAN1#121)

For UE-sided model, for inference report for BM-Case2, a time instance for prediction is defined as a slot.

Performance monitoring

Agreement (RAN1#117)

For BM-Case1 and BM-Case2 with a UE-side AI/ML model:

* Support Type 1 performance monitoring, including the following two options:
  + Option 1 (NW-side performance monitoring):
    - UE sends a report to NW (for the calculation of performance metric at NW)
      * Measurement results from resource set for monitoring, e.g., L1-RSRP and/or RS index is supported as the content of the report
      * FFS on other contents
    - The report is at least configured/triggered by NW
    - Note: this may or may not have additional spec impact
  + Option 2 (UE-assisted performance monitoring):
    - UE calculates performance metric(s)
      * FFS how to report and what to report
  + FFS whether to trigger the report based on event(s) for Option 1 and/or Option 2
* FFS Type 2 performance monitoring

Agreement (RAN1#118)

For BM-Case1 and BM-Case2 with a UE-sided AI/ML model, for Option 2 (UE-assisted performance monitoring), further study at least the following alternatives, including:

* Alt 1: Top 1 or Top K beam prediction accuracy (with or without margin) by comparing the prediction results and the Top 1 or Top K beam based on the measurements from a resource set/resources for monitoring
* Alt 2: The L1-RSRP difference information based on actual measurement of the L1-RSRP of one or more of Top K predicted beam, and L1-RSRP measurements from a resource set/resources for monitoring
* Alt 3: The RSRP difference information between the predicted RSRP and measured L1-RSRP of corresponding beam(s) of a resource set/resources for monitoring
  + Note: resources for Set B for monitoring are not precluded and can be study.
  + Note: this is only applicable when the model can predict RSRP
* Alt 4: The probability information of the predicted beam(s) to be the Top 1 or Top K beam
  + Note: this is only applicable when the model can generate probability information
* FFS: for Alt 1/2/3, on other details including how to configure the resource set/resources for monitoring, including
  + E.g. whether/how to use full set of Set A for measurement. If not, whether/how to obtain the measurement of the predicted Top 1 or Top K beam for calculating the prediction accuracy or the RSRP difference.
* For all alternatives, study whether the performance information is calculated per sample (one-shot), or per set of samples (window)

Agreement (RAN1#118bis)

For BM-Case1 and BM-Case2 with a UE-sided AI/ML model, for Option 2 (UE-assisted performance monitoring),

* At least support Alt 1: Top 1 or Top K beam prediction accuracy (with or without margin) by comparing the prediction results and the Top 1 or Top K beam based on the measurements from a resource set/ resources for monitoring
  + FFS on detail definition of the metric, including whether/how to configure or define a window for calculation
  + FFS: on other details including how to configure the resource set/resources for monitoring, including
    - E.g. whether/how to use full set of Set A for measurement. If the full set A is not configured, whether/how to define the metric
* FFS other alternatives

Agreement (RAN1#118bis)

At least for the monitoring Type 1 Option 2 of UE-side model monitoring (when applicable), consider the following options with potential down selection for the configuration for monitoring:

* ~~Option 1: The resource set(s) for monitoring and report configuration for monitoring are configured (when applicable) within CSI report configuration used for inference~~
  + ~~FFS: the resource set(s) for monitoring~~
  + ~~UE measures the resource set(s) for monitoring.~~
  + ~~FFS how/when to report the monitoring results.~~
* Option 2: Dedicated resource set(s) for monitoring and report configuration for monitoring are configured in a dedicated CSI report configuration used for monitoring
  + The dedicated report configuration used for monitoring links to an inference report configuration
    - FFS how to identify the connection between RSs in the resource set(s) for monitoring and Set A beams
  + UE measures the resource set(s) for monitoring.
  + FFS when to report the monitoring results.

Agreement (RAN1#119)

At least for the monitoring Type 1 Option 2 of UE-side model monitoring (when applicable), support to reuse CSI framework for the configuration for monitoring result report in L1 signaling:

* Dedicated resource set(s) for monitoring and report configuration for monitoring are configured in a dedicated CSI report configuration used for monitoring
  + The ID of an inference report configuration is configured in the configuration for monitoring to link the inference report configuration and monitoring report configuration
    - FFS how to identify the connection between RSs in the resource set(s) for monitoring and Set A beams
  + FFS on whether to support all the combination on time domain behavior of the *reportConfigType* for infernece report and the *reportConfigType* for monitoring report
  + FFS on the timing related issues
  + UE measures the dedicated resource set(s) for monitoring.

Agreement (RAN1#120bis)

For UE-sided model monitoring Type 1 option 2, regarding the type of resource for the set for monitoring, support at least periodic CSI-RS, semi-persistent CSI-RS and SSB

Agreement (RAN1#120bis)

For UE-sided model monitoring Type 1 option 2, support the following combination for inference report type and monitoring report type:

|  |  |  |  |
| --- | --- | --- | --- |
| Monitoring report type  Inference report type | P report | SP report | AP report |
| AP report | Not support | Not support | Support |
| SP report | Not support | Support | Support |
| P report | Support | Support | Support |

Agreement (RAN1#120bis)

For UE-sided model, regarding a CSI report corresponding to *CSI-ReportConfig* for Type 1 option 2 monitoring, .

Note: the occupation duration is a separate discussion.

Agreement (RAN1#120bis)

For UE-sided AI/ML model for beam management, for Option 2 (UE-assisted performance monitoring), the performance metric of Top 1 or Top K beam prediction accuracy is defined as:

* At least one of the Top M beam(s) of the resource set(s) for monitoring is among Top-K predicted beam(s) of Set A (e.g., linked to at least one of the Top-K predicted beam(s) of Set A based on certain rule or signalling)
  + Where K is the number of predicted beam(s) in the corresponding inference report per time instance
  + Where Top M beam(s) is the best M beam(s) based on L1-RSRP measurements of the resource set(s) for monitoring
  + M is configured by NW in CSI report configuration for monitoring
    - M= 1, 2
  + FFS: detailed rule or signalling

Agreement (RAN1#120bis)

For calculation the performance metric of Type 1 Option 2 performance monitoring for UE-sided model:

* + Support the size of a set for monitoring is the same as the size of Set A,
    - The n-th resource in the set for monitoring is linked to the n-th resource in Set A.
  + Support the size of a set for monitoring is smaller than the size of Set A

~~Working Assumption (RAN1#120bis)~~

~~At least for the monitoring Type 1 Option 2 of UE-side model monitoring, for calculation of metric for monitoring,~~

* ~~for BM-Case 1, measurement result of a transmission occasion of the CSI-RS/SSB resources for monitoring is linked with an inference report, where the CSI reference resource of the corresponding inference report has the minimal slot offset to the transmission occasion of the CSI-RS/SSB resources for monitoring.~~ 
  + ~~Wherein, the corresponding inference report, and the transmission occasion of the CSI-RS/SSB resources for monitoring are no later than the CSI reference resource corresponding to the CSI report for monitoring~~
  + ~~FFS: whether to introduce a threshold X for the minimal slot offset, and whether it is optionally configured by RRC, where the minimal slot offset~~ *~~k~~* ~~is no larger than X; otherwise, the transmission occasion for monitoring has no linked inference report.~~

~~Working Assumption (RAN1#120bis)~~

~~For BM-Case 1, the beam prediction accuracy is calculated based on~~ *~~N~~* ~~latest transmission occasion(s) of monitoring resources with linked inference report no later than CSI reference resource corresponding to the CSI report for monitoring~~

* ~~wherein~~ *~~N~~* ~~(N>=1) is configured in~~ *~~CSI-ReportConfig~~*
* ~~FFS on additional rule for counting~~ *~~N~~* ~~linked pair~~

~~For BM-Case 1, one resource set for monitoring is configured in one~~ *~~CSI-ReportConfig~~* ~~for monitoring.~~

~~Working Assumption (RAN1#120bis)~~

~~For BM-Case 2, at least support to report one beam prediction accuracy for one configured time instance, configured by one~~ *~~CSI-ReportConfig~~* ~~for monitoring,~~

* ~~only one resource set is configured in the~~ *~~CSI-ReportConfig~~*
* ~~the one configured time instance (i.e. f-th time instance of the time instance in one inference report) for metric calculation is configured in the~~ *~~CSI-ReportConfig~~* ~~for monitoring~~
* ~~FFS on whether to configure more than one time instance~~
* ~~the performance metric of the f-th time instance is calculated based on~~ *~~N~~* ~~latest transmission occasion(s) of monitoring resource with linked time instance, no later than CSI reference resource corresponding to the CSI report for monitoring~~
* ~~N (N>=1) is configured in the~~ *~~CSI-ReportConfig~~*
* ~~FFS on additional rule for counting~~ *~~N~~* ~~linked pair~~
* ~~measurement result of a transmission occasion of the CSI-RS/SSB resources for monitoring is linked with the f-th time instance for prediction, where the f-th time instance has the minimal slot offset to the transmission occasion of the CSI-RS/SSB resources for monitoring.~~ 
  + ~~Wherein, the corresponding inference reports, and the transmission occasions of the CSI-RS/SSB resources for monitoring, [FFS on the f-th time instances] are no later than the CSI reference resource corresponding to the CSI report for monitoring~~
  + ~~FFS: whether to introduce a threshold X, and whether it is optionally configured by RRC, where the minimal slot offset~~ *~~k~~* ~~is no larger than X; otherwise, the transmission occasion for monitoring has no linked time instance~~

Agreement (RAN1#121)

For beam prediction accuracy report for monitoring, the report quantity RS-PAIis (0 ≤≤ N)

* Where is the total count of accurate reference signal prediction instance(s) that meets the condition, among *N* latest transmission occasion(s) of monitoring resources that no later than CSI reference resource corresponding to the CSI report for monitoring
  + condition:
    - for the transmission occasion of monitoring resources, it has a linked inference report
    - at least one of the *nrofBestBeamforMonitoring-r19* identified CSI-RS resources, or SS/PBCH Block resources mapped to one of the *nrofreportedpredictedrs-r19* reported P-CRI(s) or P-SSBRI(s), of the linked report of the CSI Reporting Setting for inference
  + if this condition is met, the transmission occasion is counted as an accurate reference signal prediction instance; otherwise, it is not counted as an accurate reference signal prediction instance.
* Where *N* = 1, 3, 7, 15 is configured in *CSI-ReportConfig*
* the size of CSI field associated with the RS-PAIis

Agreement (RAN1#121)

For calculation the performance metric of Type 1 Option 2 performance monitoring for UE-sided model, when the size of the set for monitoring is smaller than the size of Set A,

* support the mapping of the resources in the set for monitoring to resources in Set A is configured via RRC, support
  + A X-bit bitmap with Y non-zero bits is configured by the RRC in CSI Report Config for monitoring, where X is the size of Set A and Y is the size of the set for monitoring
  + The x-th MSB of the bitmap corresponds to x-th resource in Set A
  + The y-th nonzero bit of the bitmap corresponds to the y-th entry of associated *nzp-CSI-RS-Resources* or *csi-SSB-ResourceList* in the set for monitoring, 1≤y≤Y

Agreement (RAN1#121)

* At least for the monitoring Type 1 Option 2 of UE-side model monitoring, for calculation of metric for monitoring,
* for BM-Case 1, the measurement result of nth (n = 1,..,N) latest transmission occasion of the CSI-RS/SSB resources for monitoring is linked with an inference report, where the CSI reference resource of the corresponding inference report has the minimal slot offset to the nth transmission occasion of the CSI-RS/SSB resources for monitoring.
  + Wherein, the corresponding inference report, and the transmission occasion of the CSI-RS/SSB resources for monitoring are no later than the CSI reference resource corresponding to the CSI report for monitoring
  + Predefines a threshold X = 64 for the minimal slot offset, which is configured by RRC, where the minimal slot offset *k* is no larger than X; otherwise, the transmission occasion for monitoring has no linked inference report.
* Note: CSI reference resource corresponding to the CSI report for monitoring and inference is determined based on legacy for all types (P/SP/AP) of CSI report carrying L1-RSRP, considering discussing associated timeline separately
* The associated working assumption made in RAN1#120b will not be confirmed.

Agreement (RAN1#121)

For BM-Case 2, at least support to report one beam prediction accuracy for one configured time instance, configured by one *CSI-ReportConfig* for monitoring,

* only one resource set is configured in the *CSI-ReportConfig*
* the one configured time instance (i.e. f-th time instance of the time instance in one inference report) for metric calculation is configured in the *CSI-ReportConfig* for monitoring
* the performance metric of the f-th time instance is calculated based on *N* latest transmission occasion(s) of monitoring resource, no later than CSI reference resource corresponding to the CSI report for monitoring
* The measurement result of nth (n = 1,..,N) latest transmission occasion of the CSI-RS/SSB resources for monitoring is linked with the f-th time instance for prediction, where the f-th time instance has the minimal slot offset to the nth transmission occasion of the CSI-RS/SSB resources for monitoring.
  + Wherein, the corresponding inference reports, and the transmission occasions of the CSI-RS/SSB resources for monitoring, are no later than the CSI reference resource corresponding to the CSI report for monitoring
  + Predefines a threshold X =64, where the minimal slot offset *k* is no larger than X; otherwise, the transmission occasion for monitoring has no linked time instance.
* Note: CSI reference resource corresponding to the CSI report for monitoring is determined based on legacy for all types (P/SP/AP) of CSI report carrying L1-RSRP

The associated working assumption made in RAN1#120b will not be confirmed.

Agreement (RAN1#121)

For BM-Case 1, one resource set for monitoring is configured in one *CSI-ReportConfig* for monitoring.

CPU/APU

**CSI report for data collection**

Agreement (RAN1#121)

For UE-sided model, regarding a *CSI-ReportConfig* for data collection,

* Reuse the existing CPU occupation time for a CSI report with *CSI-ReportConfig* with *reportQuantity* set to 'none' and TRS-info not configured

**CSI report for inference**

~~Agreement (RAN1#118bis)~~

~~For UE-side model, existing CPU mechanism is used as a starting point for AI/ML-based CSI processing.~~

* ~~FFS whether the overall CPU should be shared or separately counted between legacy CSI reporting and AI/ML-based CSI reporting, and among AI/ML features/functionalities.~~
* ~~FFS whether it is fully applicable for BM-Case 1 and/or BM-Case 2.~~

~~Agreement (RAN1#120bis)~~

* ~~For UE-side model, for AI/ML based beam management for BM-Case 1 and BM-Case 2, for processing of a CSI report for inference, considering the following options for potential down selection:~~ 
  + ~~Option 1: only dedicated AI/ML PU is occupied, is reported by UE.~~
    - ~~And~~
  + ~~Option 2: only legacy CPU is occupied, it is reported by UE.~~
  + ~~Option 3: both dedicated AI/ML PU and legacy CPU are occupied, is reported by UE.~~
    - ~~And~~

~~Note: The supported option by UE is reported by UE capability, if multiple options are supported.~~

* ~~The total number of dedicated AI/ML PU for AI/ML is reported by UE capability.~~ 
  + ~~Note: The total number of Use case specific dedicated AI/ML PU could be discussed separately.~~

Agreement (RAN1#121)

For UE-side model, for AI/ML based beam management for BM-Case 1 and BM-Case 2, for processing of a CSI report for inference,

* For PU occupancy, for the number of AI/ML PU (OAPU) and/or legacy CPU (OCPU) are occupied,
  + OAPU= 0 or X1/X2 is reported by UE in UE capability report for BM-Case 1 and BM-Case 2 respectively
  + OCPU=0 or Y1/Y2 is reported by UE in UE capability report for BM-Case 1 and BM-Case 2 respectively
  + Note: Detailed values of X1/X2 and Y1/Y2 can be further discussed in UE feature.
  + Note: Combination of OAPU= 0 and OCPU=0 is not allowed
  + Note: if any of the unoccupied PU cannot satisfy the corresponding required PU by the CSI report, the CSI report will follow the legacy behavior of exceeding the CPU limit, neither of the PUs are occupied

Agreement (RAN1#121)

For UE-sided model, regarding a CSI report with *CSI-ReportConfig* for inference for BM-Case1,

* + Rel-15 CPU occupation time is reused for CPU occupation time of the CSI report
  + Rel-15 CPU occupation time is reused for AI/ML PU occupation time of the CSI report
  + Note: this is applicable to all types of CSI reports (i.e., AP/SP/P CSI report)

Agreement (RAN1#121)

For UE-sided model, regarding a CSI report with CSI-ReportConfig for inference for BM-Case2, for occupancy duration of CPU and APU, same occupation time for AI/ML PU and legacy CPU.

* If the CSI report is aperiodic, for AI/ML PU, and for CPU, Rel-15 CPU occupation time for AP CSI report is reused
* If the CSI report is semi-persistent or periodic,
  + From the 1st symbol of the latest CSI-RS/SSB transmission occasion no later than CSI reference resource, until the last symbol of the PUCCH/PUSCH carrying the report.

**CSI report for monitoring**

Agreement (RAN1#120bis)

For UE-sided model, regarding a CSI report corresponding to *CSI-ReportConfig* for Type 1 option 2 monitoring, .

Note: the occupation duration is a separate discussion.

Z/Z’ timeline

Agreement (RAN1#121)

For UE-sided model, regarding a CSI report with *CSI-ReportConfig* for inference for BM-Case1 and BM-Case 2, when applicable, extend legacy Z3/Z3’ to Z3+d/ Z3’+d’, where d and d’ are reported by UE per SCS for BM-Case 1 and BM-Case 2 respectively

* Detailed values of d and d’ can be further discussed in UE feature.

CSI priority value

Agreement (RAN1#121)

For the determination of CSI report priority value of a CSI report for inference, the existing is reused

* k = 0 for the CSI report for inference

For the determination of CSI report priority value of a CSI report for monitoring, the existing is reused

* k = 0 for the CSI report for monitoring

## RAN2 LS related

Agreement (RAN1#118bis)

Answer to Q2 in [R1-2407604](file:///D:\My%20Work\Agreements\Per%20Topic\Rel-19\Docs\R1-2407604.zip) as below:

|  |
| --- |
| RAN 1 did not have agreement on the content of NW-side additional condition. RAN1 agreed to support associated ID and it can be used to ensure the consistency of NW-side additional condition across training and inference for UE-sided model for BM-Case 1 and BM Case 2. UE may assume the similar properties of a DL Tx beam or beam set/list associated with the same associated ID, while FFS whether/how to define similar properties of a DL Tx beam or beam set/list. |

Agreement (RAN1#118bis)

RAN 1 further study the following options for applicability for inference for UE-side model:

**Option 1:**

* In Step 3, following configurations are provided from NW to UE:
  + 1) UE is allowed to do UAI reporting via *OtherConfig,*
  + 2)+3) NW configures one or more *CSI-ReportConfig* for inference configuration, where the associated ID may be configured in CSI framework as working assumption applied.
  + FFS on whether some IEs in the CSI report configuration can be removed or modified
  + Note: CSI report configuration for UE-side model inference can’t be activated immediately upon receiving Step 3
* In Step 4, UE reports applicability(ies) of the above *CSI-ReportConfi*g
  + FFS on one or more of the above *CSI-ReportConfig* to be reported
* FFS on activation (including when/how) of inference report after obtaining the applicability from UE Step 4
* FFS: whether Step 5 is needed,

**Option 2:**

* In Step 3, following configurations are provided from NW to UE:
  + UE is allowed to do UAI reporting via *OtherConfig,*
  + NW configures one set or multiple sets of inference related parameters
    - Note: the set of inference related parameters is not configured by *CSI-ReportConfig*
    - FFS on the set of inference related parameters, at least including:
      * Set A related information
      * Set B related information
      * Report content related information
      * For BM-Case 2,
        + Time instances related information for measurements
        + Time instances related information for prediction
  + The associated ID(s) may be configured
    - wherein the associated ID(s) may be
      * FFS: a) part of one set of the inference related parameters, or
      * FFS: b) independently from the one set of the inference related parameters.
* In Step 4, UE reports applicability of the above one or multiple sets of inference related parameters, where the associated ID information may be associated.
* In Step 5, NW configures configuration(s) for CSI report for inference

**Option 3:**

* In Step 3, following configurations are provided from NW to UE:
  + 1) UE is allowed to do UAI reporting via *OtherConfig,*
  + 2) The associated ID(s) may be provided to UE, e.g., a new RRC parameter.
* In Step 4, UE reports by UAI
  + the applicable one or multiple sets of inference related parameters may be included.
    - FFS on the set of inference related parameters, at least including:
      * Set A related information
      * Set B related information
      * Report content related information
      * For BM-Case 2,
        + Time instances related information for measurements
        + Time instances related information for prediction
    - Note: not applicable may also be replied by UE
    - Note: if the inference related parameters are not supported for reporting, only the applicability(ies) or not is reported in Step 4.
  + the associated ID(s) may be included
    - FFS: a) as part of the inference related parameters, or
    - FFS: b) independently from the set of the inference related parameters.
* In Step 5, NW configures configuration(s) for CSI report for inference.

Note: There is no impact of configuring CSI report configuration for non-AI beam management in *RRCReconfiguration.*

Agreement (RAN1#118bis)

Incorporating below text into the general part of the LS

In RAN1’s discussion of RAN 2 terminologies on beam management,

* The concept/terminology “functionality“ of **Supported functionalities** may refer to UE-capability information/parameters i.e., Rel-19 AI/ML-specific FGs
* The concept/terminology “ functionality“ of **Applicable functionalities** may refer to *CSI-ReportConfig* for inference configuration or a set of inference related parameters or information/parameters indicated by UE
* The **Activated functionalities** may be enabled based on CSI framework.

Therefore, the meaning and the granularity of “*functionality*“ for **Applicable functionalities,** **Activated functionalities** and **Supported functionalities** may or may not be the same, depends on certain option in RAN1, and the discussion is still ongoing.

Agreement (RAN1#118bis)

Answer to Q1 in [R1-2407604](file:///D:\My%20Work\Agreements\Per%20Topic\Rel-19\Docs\R1-2407604.zip) as below,

|  |
| --- |
| In Step 2, RAN1 expects that UE reports its UE-capability information/parameters, i.e., Rel-19 AI/ML-specific FGs (including components and corresponding value ranges). These AI/ML-specific UE capability information/parameters will depend on how FGs are defined including the granularity, that will be discussed in RAN1 later in the WI. |

Agreement (RAN1#119)

* In Step 3, following configurations are provided from NW to UE:
  + UE is allowed to do UAI reporting via *OtherConfig,*
  + The applicability report is based on A) and/or B)
    - It is up to RAN 2 to design the container
    - A) one or more of *CSI-ReportConfig* for inference configuration(wherein the associated ID may be configured in CSI framework as working assumption applied)
      * Note: CSI report configuration for UE-side model inference can’t be activated immediately upon receiving Step 3
    - B) One set or multiple sets of inference related parameters for applicability report only (not for inference)
      * It is up to RAN2 to design the container.
      * The set of inference related parameters selected from the IEs in/or the IEs referred by *CSI-ReportConfig* as a starting point, e.g.,
        + the associated ID

Note: this doesn’t imply the associated ID is mandatory

* + - * + Set A related information
        + Set B related information
        + Report content related information
        + For BM-Case 2,

Time instances related information for measurements

Time instances related information for prediction

* In Step 4, UE reports applicability for all the above A) one or more *CSI-ReportConfig*and/or B) set(s) of inference related parameters
  + FFS on whether/what other information along with the applicability is needed
  + If A)is configured in Step 3,
    - Applicable aperiodic CSI Report and semi-persistent CSI report can be activated/triggered by NW after the applicability reported.
    - Applicable periodic CSI Report is considered as activated only if the applicability of the corresponding *CSI-ReportConfig*is reported in *RRCReconfigurationComplete.*
* In Step 5, NW can optionally configure *CSI-ReportConfig* for inference configuration in *RRCReconfiguration*, where the associated ID may be configured in CSI framework as working assumption applied.
  + Note: Step 5 may be optional if UE has already been configured with *CSI-ReportConfig* in Step 3

**Conclusion** (RAN1#119)

For the *CSI-ReportConfig* for inference configuration provided in Step 5,

* aperiodic CSI Report and semi-persistent CSI report can be activated/triggered by NW after *RRCReconfigurationComplete*.
* periodic CSI Report is considered as activated after *RRCReconfigurationComplete*.
* Note: UE is not expected to be configured with a *CSI-ReportConfig* for inference configuration for a non-applicable set of inference parameters or a non-applicable *CSI-ReportConfig*
  + Any specification impact is a separate discussion

Agreement (RAN1#119)

Send LS to RAN2 with below information.

RAN1 thanks RAN2 for the LS on applicable functionality reporting for beam management UE-sided model.

In RAN1’s discussion of RAN 2 terminologies on beam management,

* The concept/terminology “functionality” of **Supported functionalities** may refer to UE-capability information/parameters i.e., Rel-19 AI/ML-enabled Features/FGs
* The concept/terminology “ functionality” of **Applicable functionalities** may refer to *CSI-ReportConfig* for inference configuration or a set of inference related parameters
* The **Activated functionalities** may be enabled based on CSI framework.

Therefore, the meaning and the granularity of “functionality” for **Applicable functionalities, Activated functionalities and Supported functionalities** may or may not be the same.

RAN 1 made the following agreements related to the Questions from RAN 2:

|  |
| --- |
| Agreement   * In Step 3, following configurations are provided from NW to UE:   + UE is allowed to do UAI reporting via *OtherConfig,*   + The applicability report is based on A) and/or B)     - It is up to RAN 2 to design the container     - A) one or more of *CSI-ReportConfig* for inference configuration(wherein the associated ID may be configured in CSI framework as working assumption applied)       * Note: CSI report configuration for UE-side model inference can’t be activated immediately upon receiving Step 3     - B) One set or multiple sets of inference related parameters for applicability report only (not for inference)       * It is up to RAN2 to design the container.       * The set of inference related parameters selected from the IEs in/or the IEs referred by *CSI-ReportConfig* as a starting point, e.g.,         + the associated ID   Note: this doesn’t imply the associated ID is mandatory   * + - * + Set A related information         + Set B related information         + Report content related information         + For BM-Case 2,   Time instances related information for measurements  Time instances related information for prediction   * In Step 4, UE reports applicability for all the above A) one or more *CSI-ReportConfig*and/or B) set(s) of inference related parameters   + FFS on whether/what other information along with the applicability is needed   + If A)is configured in Step 3,     - Applicable aperiodic CSI Report and semi-persistent CSI report can be activated/triggered by NW after the applicability reported.     - Applicable periodic CSI Report is considered as activated only if the applicability of the corresponding *CSI-ReportConfig*is reported in *RRCReconfigurationComplete.* * In Step 5, NW can optionally configure *CSI-ReportConfig* for inference configuration in *RRCReconfiguration*, where the associated ID may be configured in CSI framework as working assumption applied.   + Note: Step 5 may be optional if UE has already been configured with *CSI-ReportConfig* in Step 3   Agreement  For beam management, multiple CSI reports for inference for UE-side model can be configured/activated/triggered, which is up to UE capability.  Conclusion  For the *CSI-ReportConfig* for inference configuration provided in Step 5,   * aperiodic CSI Report and semi-persistent CSI report can be activated/triggered by NW after *RRCReconfigurationComplete*. * periodic CSI Report is considered as activated after *RRCReconfigurationComplete*. * Note: UE is not expected to be configured with a *CSI-ReportConfig* for inference configuration for a non-applicable set of inference parameters or a non-applicable *CSI-ReportConfig*   + Any specification impact is a separate discussion |

RAN1 would like to provide replies on the following questions from RAN2 in R2-2407848:

**Q1: In Step 2, what is the granularity of functionality? For example, whether it is a use case (e.g. beam management), whether it is a sub-use case (e.g. beam management Case 1), or others?**

**Answer to Q1:** In Step 2, RAN1 expects that UE reports its UE-capability information/parameters, i.e., Rel-19 AI/ML-enabled Features/FGs (including components and corresponding value ranges). These UE capability information/parameters will depend on how FGs are defined including the granularity, that will be discussed in RAN1 later in the WI.

**Q2: What is the content of NW-side additional condition, i.e. is it correct the RAN2 assumption of a NW-side additional condition assumed as associated ID?**

**Answer to Q2:** RAN 1 did not have agreement on the content of NW-side additional condition. RAN1 agreed to support associated ID and it can be used to ensure the consistency of NW-side additional condition across training and inference for UE-sided model for BM-Case 1 and BM Case 2. UE may assume the similar properties of a DL Tx beam or beam set/list associated with the same associated ID, while FFS whether/how to define similar properties of a DL Tx beam or beam set/list.

**Q3: Is NW-side additional condition functionality specific?**

**Answer to Q3:** Please also refer to the answer to Q2 to understand the ongoing discussion about the associated ID for NW-side additional condition. And please refer to the agreements related to the Questions from RAN 2.

**Q4: RAN2 wonders what information is needed in Step 3 for UE to decide whether a functionality is applicable before Step 4. More specifically, RAN2 would like to ask the following questions (Q4-1 to Q4-5):**

**Answer to Q4:** And please refer to the agreements related to the Questions from RAN 2.

**Q4-1: In RAN2, it is FFS whether NW-side additional condition is mandatory or optional. In order to discuss further, RAN2 would like to understand whether it is feasible for UE to decide the applicable functionalities without NW-side additional condition?**

**Answer to Q4-1:** There is no consensus yet on whether it is mandatory or optional. There is no conclusion yet on whether it is feasible or not for UE to decide the applicability without NW-side additional condition, and RAN 1 is discussing the related issues.

**Q4-2: In RAN2, it is FFS whether configuration (e.g. inference configuration) other than NW-side additional condition can be included in Step 3. RAN2 would like to understand whether it is feasible and required for gNB to provide configuration (e.g. inference configuration) other than NW-side additional condition in Step 3 for UE to determine applicable functionalities?**

**Answer to Q4-2:** Please refer to the agreements related to the Questions from RAN 2.

**Q4-3: For UE evaluating applicable functionality reporting, if the answer to Q4-2 is Yes, what is the relationship between NW-side additional condition and configuration (e.g. inference configuration)? For example, is NW-side additional condition part of inference configuration, or is inference configuration part of NW-side additional condition, or is NW-side additional condition separate from inference configuration, etc?**

**Answer to Q4-3:** Please refer to the agreements related to the Questions from RAN 2.

**Q4-4: If the answer to Q4-2 is Yes, what is the content of configuration (e.g. inference configuration) for UE to determine applicable functionalities?**

**Answer to Q4-4:** Please refer to the agreements related to the Questions from RAN 2.

**Q5: What is the content of applicable functionality reporting in Step 4?**

**Answer to Q5:** Please refer to the agreements related to the Questions from RAN 2.

**Q6: What is the content of inference configuration in Step 5?**

**Answer to Q6:** Please refer to the agreements related to the Questions from RAN 2. The content of inference configuration as *CSI-ReportConfig* is to be designed later in RAN1.

**Q7: If inference configuration is provided in Step 3, does it activate the functionality immediately upon receiving Step 3?**

**Answer to Q7:** Please refer to the agreements related to the Questions from RAN 2.

**Q8: If inference configuration is not provided in Step 3, does configuration in Step 5 activate the functionality immediately upon receiving Step 5?**

**Answer to Q8:** Please refer to the agreements/conclusion related to the Questions from RAN 2.

**Q9: If more than one functionality are configured in Step 3 or Step 5, whether multiple/all applicable functionalities can be activated?**

**Answer to Q9:** Please refer to the agreements related to the Questions from RAN 2.

**Q10: Is L1/L2 signaling for functionality activation/deactivation needed?**

**Answer to Q10:** Please refer to the agreements related to the Questions from RAN 2. With that, RAN1 understands that L1 and MAC signalling can be used for aperiodic CSI Report and semi-persistent CSI report.

Final reply LS is approved in [R1-2410898](file:///D:\My%20Work\Agreements\Per%20Topic\Rel-19\Docs\R1-2410898.zip).

Agreement (RAN1#121)

For option B of applicability check, RAN 1 assumes that at least the following RRC parameters are to be reused:

* For both BM-Case 1 and BM-Case 2:
  + *associatedIDforSetA-r19, resourcesForSetA-r19, resourcesForChannelMeasurement, associatedIDforSetB-r19, reportQuantity-r19, reportConfigType, nrofreportedpredictedrs-r19*
* For BM-Case 2:
  + *TimeGap-r19, nroftimeinstance-r19,*
* Note: this doesn’t imply the associated ID is always present