**3GPP TSG-RAN WG4 Meeting #116bis R4-2514631**

**Prague, Czech Republic, Oct. 13-17, 2025**

**Agenda item:** 6.11.1

**Source:** Qualcomm Incorporated

**Title:** WF on [116bis][112] R19 AI for air interface

**Document for:** Approval

# Introduction

This WF captures the agreements for the discussion carried out on AI/ML under the [116bis][112]NR\_AIML\_air thread.

# Agreements

## CSI reporting requirement framework for CSI prediction

### Agreements in main session:

**Issue 1-1: Requirements for performance monitoring**

Agreement:

No performance monitoring delay requirements are specified in RAN4 for CSI prediction.

**Issue 1-4: Core requirements for PMI prediction reporting**

Agreement:

Introduce a new clause under Clause 6 (6.X) in 38.101-4 as “Reporting of predicted PMI”

**Issue 1-7: Doppler and MCS**

Agreement:

Introduce tests for 20Hz Doppler with MCS [17or19] with 16Tx ports and 2Rx in FDD

Introduce test for TDD with the details FFS

**Issue 1-8: Generalization**

Agreement:

Test setup for the generalization will be further discussed based on the following options

* Option 1: Introduce multiple tests with different MCS, which will lead to different SNR points.
* Option 2: Introduce multiple tests with different channel models. The details of the channel models are FFS.
* Option 3: the combination of option 1 and 2.

It is FFS on how to quantify the generalization performance.

**Issue 1-9: Activation**

Agreement:

No activation requirement in RAN4 spec for CSI prediction will be introduced.

* Note: it is a general understanding that UE has to be ready to start measurements for inference after sending RRC reconfiguration complete. No details will be specified in RAN4.

## RRM core requirement and testing framework for beam management

### Agreements in main session:

**Issue 2-6: KPIs for prediction**

Agreement:

* + Regarding the metric for beam ID only prediction, where top-K predicted beam(s) are reported, RAN4 only specifies the requirements for the following scenario(s):
    - K=1
      * In this case, the ground truth RSRP of the predicted beam is larger than or equal to the ground-truth RSRP of the strongest genie-aided beam(s) – x dB

**Issue 2-8: Test system setup**

Agreement:

A multi-AoA IFF based test setup with 4 active cross-polarized probes placed in the single plane (xz plane). The relative angular separation between neighboring probes is 30º, 60º, and 60º, respectively.

**Issue 2-9: Simplified Channel models**

Agreement:

RAN4 will further discuss the simplified Uma and UMi channel model by taking the following aspects into consideration

* Commercial test system limitation, including the number of probes and the separation
* Model simplification should not result in inference performance degradation beyond the margin when the training is done based on the original models.
  + The margin can be discussed and decided further.
* Other aspects are not precluded.

### Agreements in ad-hoc session (R4-2416432)

**Issue 2-1: Measurement period for inference – case 2**

Agreement:

Measurement period for inference – case 2

K(number of samples)\*[M]\*N\*P

K as defined by RAN1

**Issue 2-2: Reporting delay**

Agreement for reporting delay:

Reuse d’ as to be agreed by RAN1

d’ to be added to the measurement period to reflect the extra time needed by the UE to perform inference

Depending on the RAN1 specifications, d’ shall not be double counted in the overall delay for periodic, aperiodic or semi-persistent reporting

Final specifications to be agreed after RAN1 includes d’ in the specs

**Issue 2-3: Reporting delay requirements for monitoring**

Agreement:

Do not define any explicit requirements for reporting delay of RS-PAI performance monitoring metric.

**Issue 2-4: Draft CRs**

CR drafting:

Introduce a new suffix for beam prediction requirements – X (applicable for all new requirements related to beam prediction)

For TCI state switching, introduce a new clause 8.10.2X replicating the known TCI state condition clause for the beam prediction use case

For L1-RSRP, introduce requirements also for SSB to SSB prediction for ~~case 1 and~~ case 2, reuse the same requirements as CSI-RS as applicable (for example only periodic resources)

Introduce new clause on L1-RSRP measurements for prediction 9.5X, include SSB based prediction and CSI-RS based prediction as different subclauses

For performance requirements (including test cases), consider separately SSB to SSB, SSB to CSI-RS and CSI-RS to CSI-RS prediction cases, including downselecting to even a single case.

## RRM core requirement and testing framework for Positioning accuracy enhancement

### Agreements in ad-hoc session (R4-2514632)

**Issue 3-1: Requirements for case 1**

To be clarified in the requirements:

* Request location information message should refer to “case 1” positiniong
* Reuse the legacy RSTD measurement delay for all the cases (with gap, w/o gap, PRS aggregation)
* Beam sweeping factor for FR2 including sweeping reduction factor
  + Take the legacy values
* Rx TEG: check on signaling, take the legacy(used in RSTD measurements) approach if it is signaled
* Cover all RRC states

CR structure:

* Introduce new clause for AI/ML based positioning case 1
* Reference existing requirements wherever they are reused to avoid duplicating the same requirement

Introduce requirements for each RRC state in the corresponding clauses:

Draft for RRC idle: Nokia

Draft for RRC connected: E///

Draft for RRC inactive: Nokia

**Issue 3-2: CR for case 3a/3b**

Agreement:

Clause 13.2(Rx-Tx reporting) from R4-2513670 (CMCC) to be merged into R4-2514119 (Ericsson).

CMCC to further check until end of this meeting on other clauses

E/// to provide final CR in RAN4#117

**Issue 3-3: Testing for case 1**

Agreement:

Introduce “case 1” tests only for reporting delay, one for FR1 and one for FR2

* Only connected mode
* Only reporting delay to be tested
* Only for the case with gaps

# Annex on proposed channel simplification methods

This annex is just informative on the channel simplifications methods proposed so far:

**FFS:**

“Nokia” Procedure:

1. Drop 24 clusters in the environment based on the original CDL-C UMi model.
2. *Free to choose 1, 2, …, up to 32 SSBs based on the codebook to form various test cases.*
3. *For any one test case, use the selected number of SSB to illuminate those 24 clusters. Keep the illuminated clusters and ignore the rest of the clusters.*
4. Further ignore the week clusters based on the illuminated clusters.
5. The retained illuminated clusters form the power angular spectrum/density (PAS) for TE vendor to start with. *Slightly cluster-drafting is OK to meet the angles of probes in the TE chamber*.

Example:

1. Given 32 SSBs setup and assuming the UE is on the right-hand side of the base station, 16 of SSBs sent to the left hand-side of base station will not be received by UE. Therefore, only need to send 16 SSBs on the right-hand side of the base station to the UE. Then, the clusters illuminated by those 16 SSBs need to be simulated in the TE. Follow steps 4 and 5 to the end of the procedure.
2. Artificial use case: still given 32 SSBs setup and assuming the UE is on the right-hand side of the base station. Only choose to send 4 SSBs on the right-hand side of the base station to the UE, only need to pick up the clusters illuminated by those 4 SSBs to be represented in the TE chamber. Follow steps 4 and 5 to the end of the procedure.

Pros and cons:

1. Maintain the channel characteristics of CDL-C UMi model.
2. Accurate PAS as a reference for TE chamber to emulate.
3. For the use case based on full 32 SSBs or some of “more-than-1-SSB” test cases, the PAS is formed by more clusters.
4. Various (artificial) test cases can be formed.

QC/R&S Procedure:

1. Drop 24 clusters in the environment based on the original CDL-C Umi model.
2. *Remove the week clusters from the 24 clusters to form a new cluster map in the environment (less than 24 clusters).*
3. *Generate all 32* SSBs based on the codebook to form the test cases, which illuminate all the clusters in the new cluster map.
4. Further ignore the week clusters based on the new cluster map.
5. The retained illuminated clusters form the power angular spectrum/density for TE vendor to start with. *The cluster drafting is applied to meet the angles of probes in the TE chamber.*

Pros and cons:

1. Risk of changing the channel characteristics of CDL-C UMi model to unknown channel characteristics.
2. Less accurate PAS as reference for TE chamber to emulate due to step 2.
3. The PAS is formed by fewer clusters for the “32-SSBs” test case.
4. One test case (or fewer test cases) can be formed based on the 32-SSBs setup.