**3GPP TSG-RAN WG4 Meeting#112 R4-24135xx**

**Maastricht , NL, 19th – 23th Aug, 2024**

**Agenda item:**  8.11.5

**Source:** ZTE Corporation

**Title:** WF for [112][305] NR\_BS\_RF

**Document for:** Information

# Agreement for U6GHz EIRP mask

Agreement:

* Without the extension of EERIP definition for generic use case;
* Expected EIRP (EEIRP) is defined as the average value of the EIRP, with the averaging being performed over ~~different~~ supported weighted beamforming directions within the BS horizontal and vertical steering range and the averaging being performed over horizontal angles from −180° to +180° and the specified elevation angle range θL ≤ θ < θH in Table 9.9.2-1.
* FFS on the definition of beam steering range and further clarify the relationship between beam steering range and beam peak direction sets.
* Keep the above definition in the clause 9.9
* θHL ≤ θ < θHH and capture this in the abbreviation section.

**Issue 2-2 CAR related issue**

* Proposal 1: Add additional mandatory beam identified to the declarations list for EEIRP cases. [Huawei]
* Proposal 2: The concept of CAR (Coverage Angular Range) could be discussed for the conformance testing, while it is not relevant to the core requirement specified for the expected EIRP. [Samsung]
* Recommended for WF:
	+ Proposal 2 is agreeable;
	+ For proposals 1, to have additional mandatory mechanical downtilt declaration is needed;

Agreement:

To declare the supported mechanical tilt for CAR/beam steering direction sets for BS conformance testing

**Issue 2-3 The applicability of multi-user beamforming**

* Proposal 1: RAN4 to discuss whether the agreed framework and core requirements for the upper 6GHz band is applicable to multi-user beamforming or not. [Qualcomm]
* Recommended for further discussion:
	+ Need further discussions

Agreement:

To focus on the single user beamforming for EEIRP measurement.

**Issue 2-4 TP to TR 38.908**

* TP [R4-2412707](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412707.zip) from ZTE
* TP R4-2412899 from Nokia
* TP R4-2413221 from Ericsson
* Recommended for further discussion:
	+ Need further discussions

**Issue 2-5 draft CR to TS 38.104**

* Draft CR [R4-2411641](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411641.zip) from Samsung
* Draft CR [R4-2412706](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412706.zip) from ZTE
* Draft CR [R4-2412898](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412898.zip) from Nokia
* Draft CR R4-2413222 from Ericsson
* Draft CR [R4-2413274](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413274.zip) from Huawei
* Recommended for further discussion:
	+ Pick one of them to further discuss which depends on the offline work split discussions.

**Issue 4-1:**

Agreement:

* + Proposal 1: EEIRP calculation in discrete form in the conformance test specification.

$$\overline{}\left(\_{}\_{}\right)\sum\_{}^{}\_{}\_{}\left(\_{}\_{}\_{}\_{}\right)$$

, where $\_{}$ is a beam weighting and $\_{}\left(\_{}\_{}\_{}\_{}\right)$ is the EIRP pattern per measured test beam.

$$\_{}\frac{\left(\_{}\_{}\right)}{\left(\left(\_{}\right)\left(\_{}\right)\right)}\sum\_{\_{}}^{\_{}}\sum\_{}^{}\overline{}\left(\_{}\_{}\right)\left(\_{}\right)$$

Where

* M is the number of the equally divided intervals over the horizontal (azimuth) range of −180° to +180°;
* N is the number of the equally divided intervals over the specified vertical (elevation) range of θL to θH.
* $\_{}$ is the lowest elevation sampling angle within the $\left(\_{}\_{}\right)$ bounding range
* $\_{}$ is the highest elevation sampling angle within the $\left(\_{}\_{}\right)$ bounding range
* $\_{}$ is the vertical angle measured within the n-th interval out of the vertical range of θL to θH, where the interval is from $\_{}\frac{}{}\left(\_{}\_{}\right)$ to $\_{}\frac{}{}\left(\_{}\_{}\right)$,
* $\_{}$ is the horizontal angle measured within the m-th interval out of the horizontal range of −180° to +180°, where the interval is from $\frac{}{}$ to $\frac{}{}$.

i means different bin index.

**Issue 4-5: Test environment**

Agreement:

Only normal condition is considered.

**Issue 4-8: Test tolerance requirements**

* + Proposal 1 TT=0, [Huawei, ZTE, Ericsson]
* Agreement:
	+ To agree the test tolerance as 0dB;

# Open issues for U6GHz EIRP mask

**Issue 4-2: Test vectors for EEIRP mask**

Agreement:

Companies are encourage to provide the inputs for test beams for EERIP measurement;

**Issue 4-3: Measurement grid over elevation angle and azimuth angle**

Agreement:

Companies are encourage to provide the inputs for measurement step size for EERIP measurement;

**Issue 4-4: RF channels for the conformance testing**

* + Proposal 1: B, T [Nokia]
	+ Proposal 2: M. [Huawei]
	+ Proposal 3: T [Ericsson]

Agreement:

Companies are encourage to provide the inputs for RF channels for conformance testing

**Issue 4-6: Test procedures**

* + Proposal 1: RAN4 need to capture the high-level test procedure above in BS RF conformance test specification in the new sub-clause for OTA spatial emission.
	+ Proposal 2: RAN4 need to create entry in TR 37.941 for OTA spatial emission requirement and corresponding conformance test aspects, such as measurement procedure, calibration procedure and measurement uncertainty evaluation.

Agreement:

Companies are encourage to provide the inputs for test procedures for EEIRP measurement.

**Issue 4-7: Measurement uncertainty and CI**

* + Proposal 1: EEIRP summation Error is 0.75dB [Huawei]
	+ Proposal 2: follow the legacy approach adopted for TRP accuracy requirements as baseline [ZTE, Huawei]
	+ Proposal 3 : MU and CIs are different measures and one cannot exchange one for the other but MU needs to be taken into account when estimating the CI [Spark]
	+ Proposal 4: If the numbers of samples (N) is large say >20 the students t distribution and Normal distribution CIs are similar, and any can be chosen. [Spark]
	+ Proposal 6: RAN5 to consider defining the estimation/measurement accuracy error as the difference between the expected EIRP over the oversampling factors ($O\_{azim},$ $O\_{elev}$) and ($L\_{azim},$ $L\_{elev}$) relative to the largest oversampling factor allowed (where testing is done).

Agreement:

Companies are encourage to provide the inputs for MU and CI values based on the assumption of test beams and measurement grid size.

**Issue 4-9: Others**

* + Proposal 1: unless there are clear benefits identified to align the coordinate system between EEIRP mask and legacy 3GPP coordinate system, it’s not necessary to have such kind of converting. [ZTE]

# Open issues for co-location reference antenna

**Issue 3-1: General**

* + Proposal 1: RAN4 shall continue to study/refine CLRA/CLTA definition, by targeting to prepare these definitions for 6G base station specification (i.e., it could be too late to change NR specification). [Samsung]
	+ Proposal 2: RAN4 could consider to study the CLRA definition in a longer timeframe, e.g., to suggest RAN-P to extend this study to next release if more time/study is identified to be needed. [Samsung]
* Recommended for discussion
	+ Proposal 2 needs further discussions since this is not aligned with the current work plan for this WID.
		- RAN4 are working on the proposal 1 to identify the appropriate CLTA definition.

**Issue 3-2: Co-location reference antenna**

* + Proposal 1: Based on observed technical issues with current definition of transmitter spurious emission requirement and receiver out-of-band blocking requirement for BS type 1-O, adopt the workflow above to enable an evolution for BS RF co-location requirements supporting larger array antenna structures operating at frequencies above 2.5 GHz. [Ericsson]
	+ 
	+ Proposal 2: RAN4 shall set up an evaluation plan to evaluate the antenna isolation in the AAS-to-AAS co-location deployment scenario, with the following parameters considered: [Samsung]
* 3 sector scenario is under consideration:
	+ The angle between every two sectors’ boresight directions is 120 degrees;
	+ Sector antenna panel’s width is 180mm;
	+ Between two sectors’ antenna panel:
		- The center-to-center distance is: 150mm;
		- The nearest distance between edge to edge is: 60mm;
	+ For each antenna panel:
		- Non-SBFD case: M column and N rows in each antenna panel;
		- SBFD case: M column and 2\*N rows in each antenna panel, with certain structure between TX/RX panels;
	+ 3.5GHz/upper 6GHz for operating frequency, with 100MHz bandwidth.
	+ Proposal 3: After identifying the required MCL values for the co-location deployment scenario for different frequency bands, RAN4 can use the antenna port-to-port isolation estimation for side-by-side CLRA setup to to identify 0.1m separation is enough or not. (Note: the Table in R4-1706766 could be the exemplary antenna port-to-port isolation estimation). [Samsung]
* Recommended for discussion
	+ Further discuss the above proposals.
	+ Further discuss whether the side by side co-location deployment is typical scenario or worst assumption;
	+ If RAN4 agree to conduct the Electromagnetic (EM) evaluation for spatial isolation between BSs after co-location scenarios,
* Option 1: HFSS, cst, feko
* Option 2: measurement results in the testing lab.

**Issue 3-3: MCL assumption**

* + Proposal 1: Keep the existing assumption of 30dB coupling loss. [Nokia]
* Recommended for discussion
	+ Need further discussions which depends on the outcome of further studies in the previous issues.

**Issue 3-4: the applicability of Tx IMD requirement**

* + Proposal: It is proposed to remove TX IMD requirements for high FR1 band, e.g. frequency bands above 4.2 GHz. [Huawei]
* Recommended for discussion
	+ Need further discussions.

#  Work split for EEIRP mask

|  |  |
| --- | --- |
| TS | Company |
| 38.104 | ZTE |
| 38.141-2 Declarations | [CATT] |
| 38.141-2 Test procedure | Huawei |
| 38.141-2 Annex for EEIRP calculation | [Nokia] |
| 38.908 Background | [Spark] |
| 38.908 RF requirement | [Samsung] |
| 38.908 Conformance testing requirement and procedures | Ericsson, ZTE, Huawei |