**3GPP TSG-RAN WG4 Meeting # 100-e R4-211XXXX**

**Electronic Meeting, August 16-27, 2021**

**Agenda item:** 9.9.1

**Source:** Samsung

**Title:** WF on UE RF requirement for FR2 HST

**Document for:** Approval

# 1 Minimum Peak EIRP

**Issue 2-1-1: Minimum Peak EIRP**

Proposals:

* Proposal 1 (Ericsson): (By revisiting last meeting agreement) Increase maximum output power for train mounted HST FR2 UEs, consider PC1 as baseline.
* Proposal 2 (Samsung): (By following last meeting agreement) For FR2 HST UE, RAN4 adopt the minimum peak EIRP requirement for the relevant bands n261, n257 and n258, as

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| **Operating band** | **Min peak EIRP (dBm)** |
| n257 | 30.0 |
| n258 | 30.4 |
| n261 | 30.0 |
| NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance |

[Moderator] Continue the discussion on:

* The feasibility of applying the PC1-like UE (with maximum EIRP limit of 55dBm) in mobility usage scenario:
	+ Quote from Intel’s comment in 1st round: “In our understanding, PC1 cannot be used for HST since the max EIRP limit of 55 dBm is for transportable stations, which the FCC defines as transmitting equipment that is not intended to be used while in motion, but rather at stationary locations (47 CFR § 30.2 – Definitions).”
* The technical argument why PC5-like 30.x dBm minimum peak EIRP requirement shall be revisited:
	+ Which parameters are changed as the baseline to derive requirement?
	+ What other factors are changed?

[Moderator] Suggest to further discussion on the following tentative agreement in Wed. GTW session.

[Moderator] Early comments before GTW are also encouraged to be captured in the 2nd round summary.

**Issue 2-1-2: Multi-band Relaxation**

Agreements:

* For FR2 HST UE, RAN4 adopt 0.7dB multi-band relaxation similar as PC5, that is

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| **Band** | **MBP,n (dB)** | **MBS,n (dB)** |
| n257 | 0.7 | 0.7 |
| n258 | 0.7 | 0.7 |
| n261 | 0.7 | 0.7 |

# 2 Spherical Coverage

**Issue 2-2-1: Spherical coverage requirement framework**

Candidate options:

* Spherical coverage requirement framework for FR2 HST UE:
	+ Option-1: Still follow Rel-15 NR spherical coverage requirement framework
	+ Option-2: Specify the spherical coverage for FR2 HST in terms of theta and phi range w.r.t. boresight direction.

[Moderator] Recommendations for 2nd round:

* Continue discussion on the above two options, and the supporters of Option-2 may want to address the questions and concerns in 1st round as below:
	+ Even if the required spherical region, the traditional spherical coverage definition still works?
	+ More details about new framework: e.g., azimuth/elevation angle range (w.r.t. boresight direction) is assumed for the “required range”, how much %-tile is required over the range?

[Moderator] Suggest to further discussion for down-select to one option as follows in Wed. GTW session.

[Moderator] Early comments before GTW are also encouraged to be captured in the 2nd round summary.

**Issue 2-2-2: Spherical coverage x%-tile point**

Candidate options:

* Spherical coverage x%-tile point:
	+ Option-1 (Samsung) : 90%-tile point, i.e., 10% coverage with 2 back to back panels
	+ Option-2 (Qualcomm): 30% with 2 back to back panels (still over the whole sphere)
		- Or further smaller coverage (as mentioned by Qualcomm)
	+ Option-3 (Nokia/Ericsson): high EIRP requirement (more than 30.x dBm) without no coverage requirement

[Moderator] Recommendations for 2nd round:

* We encourage companies to further consider above options by taking into account the agreement from RRM session and deployment session (copied here for convenience):

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| <Copied from RRM session chairman notes>* Agreements:
	+ RX beam number for RRM requirements definition
		- Define two set of requirements for Scenario A and Scenario B in terms of number of RX beams per UE
			* Scenario A: [2] RX beams for all scenarios
			* Scenario B: [6] RX beams for all scenarios
			* FFS on feasibility and methods to differentiate scenarios from UE perspective
			* FFS if different UE capabilities shall be used for Scenario A and B support
		- Note: if there is insignificant difference between Scenario A and B requirements, then further discussion on unified requirements can take place
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| <Copied from deployment scenario session chairman notes>Agreement:No dedicated performance RAN4 requirements will be specified for Bi-directional deployment for Scenario A by assuming the requirements will be specified under uni-directional deployment which pending on further confirmation in RRM session for the feasibility of uni-directional deployment.Capture relevant information for the analysis of all possible deployment and schemes into TR, and some comparison analysis can be also included. Agreement: Introducing performance requirements for both uni-directional and bi-directional deployment in scenario B which pending on further discussion on following aspect:-The test applicable rules can be further discussed and introduced if needed- FFS whether single test case cover both uni-directional and bi-directional deployment- BS declaration for applicable test cases can be further discussed -Test feasibility for bi-directional deployment under performance test cases -Performance comparision among uni-directional and bi-directional deployment  |

[Moderator] Suggest to further discussion for down-select to one option as follows in Wed. GTW session.

[Moderator] Early comments before GTW are also encouraged to be captured in the 2nd round summary.

**Issue 2-2-3: Spherical coverage requirement (EIRP drop)**

[Moderator] The detailed value of EIRP drop from the peak EIRP value is still FFS.

Candidate methods to decide EIRP drop:

* Option 1:
	+ Set EIRP drop requirement to keep received power at gNB stable.
* Other option not precluded.

[Moderator] Comments are encouraged to be captured in the 2nd round summary.

# 3 UE RF requirement framework and Power Class

**Issue 2-3-1: UE RF requirement framework**

Candidate options:

* Option-1: For HST FR2 UE, RAN4 only defines RF requirement in the case where UE receives the HST FR2 network deployment flag. No requirement is defined when HST FR2 UE has not received the HST FR2 network deployment flag.
* Option-2: The RF requirement applicability rule (based on NW flag signalling) is not introduced.

[Moderator] Suggest to further discussion for down-select to one option as follows in Wed. GTW session.

[Moderator] Early comments before GTW are also encouraged to be captured in the 2nd round summary.

**Issue 2-3-2: UE Power Class**

Questions to further discuss in 2nd round:

* Question-1: Different RF requirements for scenario A and B respectively?
* Question-2: Different RF requirements for uni-and bi-directional respectively?

[Moderator] Recommendations for 2nd round:

* Ericsson’s proposal on new power class is reasonable (even Ericsson’s proposal on higher minimum peak is not agreed, new spherical coverage is still expected), but other questions about whether or not different RF requirement for different scenarios (A vs. B, uni- vs. bi-) need to be addressed.
* Discussion on above question-1 and 2 are encouraged.

[Moderator] Comments are encouraged to be captured in the 2nd round summary.

# 4 Beam Correspondence for FR2 HST UE

**Issue 2-4-1: Requirement impact for Rel-15 Beam Correspondence Feature**

Agreement:

Requirement impact for Rel-15 Beam Correspondence Feature

* Option-1: No need to introduce BC tolerance requirement because all FR2 HST UE need mandatory support of Rel-15 BC without uplink beam sweeping.
	+ If Rel-15 BC feature *beamCorrespondenceWithoutUL-BeamSweeping* is mandatorily supported by FR2 HST UE, then by following PC3 BC requirement:
		- For Rel-15 BC-capable UE, the UE shall meet the minimum peak EIRP requirement and spherical coverage requirement with its autonomously chosen UL beams and without uplink beam sweeping. Such a UE is considered to have met the beam correspondence tolerance requirement.
	+ In other words, we don’t need to introduce BC tolerance requirement as Rel-15 PC3.

**Issue 2-4-2: The necessity of support Rel-16 optional feature *beamCorrespondenceSSB-based-r16*?**

Candidate options:

* Option 1 (Nokia, Qualcomm, Ericsson): *beamCorrespondenceSSB-based-r16* shall be mandated to FR2 HST UE.
* Option 2 (Samsung, Huawei, Qualcomm):
	+ FR2 HST UE is not required to support Rel-16 optional feature *beamCorrespondenceSSB-based-r16*.
	+ No need to define corresponding requirement for Rel-16 optional feature *beamCorrespondenceSSB-based-r16* for Rel-17 FR2 HST UE.

[Moderator] Recommendations for 2nd round:

* More email discussion to see if we can compromise to one option, based on which we can define requirement in next meeting.

**Issue 2-4-3: The necessity of support Rel-16 optional feature *beamCorrespondenceCSI-RS-based-r16*?**

Candidate options:

* Option 1 (Qualcomm, Nokia):
	+ Whether to make UE support of Rel-16 optional feature *beamCorrespondenceCSI-RS-based-r16* mandatory depends on the availability of frequent CSI-RS configuration in FR2 HST deployment.
* Option 2 (Nokia, Huawei): *beamCorrespondenceCSI-RS-based-r16* shall be optional to FR2 HST UE.
* Option 3 (Samsung):
	+ FR2 HST UE is not required to support Rel-16 optional feature *beamCorrespondenceCSI-RS-based-r16*.
	+ No need to define corresponding requirement for Rel-16 optional feature *beamCorrespondenceCSI-RS-based-r16* for Rel-17 FR2 HST UE.

[Moderator] Recommendations for 2nd round:

* More email discussion to see if we can compromise to one option, based on which we can define requirement in next meeting.

# 5 RX Requirement for FR2 HST UE

**Issue 2-5-1: REFSENS requirement:**

Agreement:

REFSENS requirement:

* Option 1: For FR2 HST UE, RAN4 adopt REFSENS requirement as PC5, that is

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| **Operating band** | **REFSENS (dBm) / Channel bandwidth** |
| **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** |
| n257 | -92.6 | -89.6 | -86.6 | -83.6 |
| n258 | -92.8 | -89.8 | -86.8 | -83.8 |
| N261 | -92.6 | -89.6 | -86.6 | -83.6 |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4 |

* Other options not precluded.

# References

[1] R4-2114732, “Email discussion summary for [100-e][132] NR\_HST\_FR2\_enh”, Samsung