**3GPP TSG-RAN WG4 Meeting#111 R4-240xxxx**

**Fukuoka, Japan，20th – 25th May2024**

**Agenda item:** 11.3

**Source:** Moderator (Apple)

**Title:** Topic summary for [111][230] Reply\_LS

**Document for:** Information

# Introduction

This topic summary covers AI 11.1 and 11.2, including the following incoming LS.

* LS on combination of HST and RRM relaxation (R2-2311435)
* LS on defining the missing relative angular offsets and UE gain-related parameters for different power classes (R5-237837)

# Topic #1: LS on combination of HST and RRM relaxation (R2-2311435)

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [R4-2408180](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408180.zip) | CR on combination of HST and RRM relaxation | CMCC | Endorsed CR in the last RAN4 meeting. |
| [R4-2408181](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408181.zip) | CR on combination of HST and RRM relaxation | CMCC | Endorsed CR in the last RAN4 meeting. |
| [R4-2408182](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408182.zip) | CR on combination of HST and RRM relaxation | CMCC | Extending the changes in 8180 to Rel-16. |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

## Open issues summary

### Sub-topic 1-1: Maintainance for the requirement on combination of HST and RRM relaxation

In RAN4#110bis meeting, the CR on combination of HST and RRM relaxation was endorsed in R4-2406389 (R17) and R4-2406390(R18). T-doc R4-2408180 and R4-2408181 are the re-submissions of the endorsed CR for formal approval.

And further it is found that the endorsed changes in R4-2406389 are also applicable for Rel-16

**Issue 1-1-1: Agree the set of CRs in R4-2408180 and R4-2408181 which are endorsed in last meeting?**

* Proposals
  + Option 1: Yes
  + Proposal 2: No, please provide comments.
* Recommended WF

**Issue 1-1-2: Agree the set of CRs in R4-2408182?**

* Proposals
  + Option 1: Yes
  + Proposal 2: No, please provide comments.
* Recommended WF

# Topic#2: missing relative angular offsets and UE gain-related parameters for different power classes

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [R4-2408576](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408576.zip) | Discussion on RAN5 LS reply on missing parameters | Huawei, HiSilicon | **Proposal 1: The Gmin and Gmax for PC 1/5/6 are defined as:**   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  | UE Power class | | | | | | |  | 1 | 2 | 3 | 4 | 5 | 7 | | **Minimum, dBi** | **0** | **FFS** | **-10** | **FFS** | **-5** | **FFS** | | **Maximum, dBi** | **57** | **FFS** | **+20** | **FFS** | **57** | **FFS** |   **Observation 1: The beam misalignment between fine beam and rough beam will lead to severer rough beam gain reduction for PC1/5/6 since:**   * **Narrower beam with more antenna elements** * **Looser requirements for spherical coverage performance**   **Proposal 2: The rough beam gain reduction for PC1/5/6 are defined as:**  Rough Beam gain reduction “D” in Rx Beam Peak direction   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  | UE Power class | | | | | | |  | 1 | 2 | 3 | 4 | 5 | 6 | | Maximum gain reduction, dB | 11.5 | FFS | 5.5 | FFS | 8.5 | 8.5 | |
| [R4-2408650](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408650.zip) | Reply LS on defining the missing relative angular offsets and UE gain-related parameters for different power classes | Nokia | LS reply |
| [R4-2408651](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408651.zip) | On Missing RAN4 PC1, 5, and 6 Parameters for RAN5 | Nokia | **Proposal 1: RAN4 not to define UE gain to PRS-RSRP measurement point for FR2 (Clause B.2.1.6) for PC1, PC5, and PC6, unless the need for those is explicitly justified.**  **Observation 2**: The minimum value of UE gain G for PC1, 5, and 6 devices (Table B.2.1.5.1-1) can be estimated based on the difference in reference sensitivity to the PC3. The minimum beam gain for the specialized (FWA/CPE) types of devices is expected to be higher than for PC3.  **Proposal 2: For the definition of maximum value of UE gain G for PC1, 5, and 6 devices (Table B.2.1.5.1-1), RAN4 to use the following assumptions for the number of antenna elements PC 1: 64; PC 5: 36; PC 6: 36 that is consistent with the calculation of Y and Z.**  **Proposal 3: RAN4 to define the following values for the UE gain G, Rx beam peak direction (Table B.2.1.5.1-1):**  **Proposal 4: For PC 1, 5, and 6, specify UE gain difference between inter-frequencies Ginter equal to 3 dB (Option 1).**  **Proposal 5: RAN4 to define the values of Minimum SSB\_RP in Table B.2.2-2: Conditions for intra-frequency measurements in FR2 for PC6 devices as shown in the table above and inform RAN5 about the change.** |
| [R4-2408652](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408652.zip) | CR to 38.133 Rel-15 CatF on Missing PC1 Test Parameters for RAN5 | Nokia | Cat F |
| R4-2408653 | CR to 38.133 Rel-16 CatA on Missing PC1 Test Parameters for RAN5 | Nokia | Cat A |
| R4-2408654 | CR to 38.133 Rel-17 CatA on Missing PC1 Test Parameters for RAN5 | Nokia | Cat A |
| R4-2408655 | CR to 38.133 Rel-18 CatA on Missing PC1 Test Parameters for RAN5 | Nokia | Cat A |
| [R4-2408656](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408656.zip) | CR to 38.133 Rel-17 CatF on PC5,6 RRM Test Configuration Parameters for RAN5 | Nokia | Cat F |
| R4-2408657 | CR to 38.133 Rel-18 CatA on PC5,6 RRM Test Configuration Parameters for RAN5 | Nokia | Cat A |
| [R4-2408886](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408886.zip) | Discussion on defining the missing testing parameter for PC1/5/6 | Samsung | **Observation 1: The D for FWA will become looser than PC3.**  **Proposal 1: For the gain difference Y and Z between fine beam and rough beam for PC1/5/6, the square brackets can be removed.**  Table B.2.1.3.1-1: Gain difference Y between fine and rough beams, Rx beam peak direction   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Value "Y" in dB, for each UE power class | | | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 18 | 9.0 | 7.0 | FFS | 15.5 | 15.5 | FFS |   Table B.2.1.3.2-1: Gain difference Z between fine and rough beams, Spherical coverage directions   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Value "Z" in dB, for each UE power class | | | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 18 | 9.0 | 7.0 | FFS | 15.5 | 15.5 | FFS |   **Proposal 2: The UE gain G for PC 1/5/6 are:**  Table B.2.1.5.1-1: UE gain G, Rx beam peak direction   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | |  | UE Power class | | | | | | | |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | Minimum, dBi | -22 | FFS | -10 | FFS | -22 | -22 | FFS | | Maximum, dBi | +26 | FFS | +20 | FFS | +24 | +24 | FFS |   **Proposal 3: There is no need to define the value of rough beam gain reduction “D” in B.2.1.5 for PC6**  **Proposal 4: The value of rough beam gain reduction “D” in B.2.1.5 for PC1/PC5 are as follows:**  Table B.2.1.5.3-1: Rough Beam gain reduction “D” in Rx Beam Peak direction   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | UE Power class | | | | | |  | 1 | 2 | 3 | 4 | 5 | | Maximum gain reduction, dB | 10 | FFS | 5.5 | FFS | 10 |   **Proposal 5: For UE gain difference between inter-frequencies Ginter, 3dB for PC1 and PC6**  **Proposal 6: There is no need to define G gain in Clause 2.1.6 Gain to PRS-RSRP measurement point for FR2 for PC6**  **Proposal 7: For the UE gain to PRS-RSRP measurement point for FR2 for PC1/PC5**  Table B.2.1.6.1-1: UE gain G, Rx beam peak direction   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  |  | UE Power class | | | | | |  | 1 | 2 | 3 | 4 | 5 | 7 | | Minimum, dBi | -22 | FFS | -10 | FFS | -22 | FFS | | Maximum, dBi | +26 | FFS | +20 | FFS | +24 | FFS | |
| [R4-2409365](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409365.zip) | Missing Parameters for FR2 RRM Testing of Different Power Classes | Qualcomm Incorporated | Proposed updates to Table B.2.1.3.1-1 of TS 38.133 : Gain difference Y between fine and rough beams, Rx beam peak direction   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Value “Y” in dB, for each UE power class | | | | | | | 1 | 2 | 3 | 4 | 5 | 7 | | 18  (10\*log(64)) | 9.0 | 7.0 | FFS | 15.5 (10\*log(36)) | FFS |   Proposed updates to Table B.2.1.3.2-1: Gain difference Z between fine and rough beams, Spherical coverage directions   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Value “Z” in dB, for each UE power class | | | | | | | 1 | 2 | 3 | 4 | 5 | 7 | | FFS  (10\*log(64)) | 9.0 | 7.0 | FFS | 15.5  (10\*log(36)) | FFS |   Proposed values for Table B.2.1.5.1-1: UE gain G, Rx beam peak direction   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  | UE Power class | | | | | | |  | 1 | 2 | 3 | 4 | 5 | 7 | | Minimum, dBi | 0 | FFS | -10 | FFS | -5 | FFS | | Maximum, dBi | 57 | FFS | +20 | FFS | 57 | FFS |   Proposed values for the inter-frequency gain difference Table B.2.1.5.2-1: UE gain difference between inter-frequencies Ginter   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | UE Power class | | | | | |  | 1 | 2 | 3 | 4 | 7 | | Maximum difference, dB | 3 | FFS | 3 | 3 | FFS |   **Proposal: Reply to RAN5 with the values in the tables above and also approve a CR to 38.133 to make the necessary updates** |

## Open issues summary

The missing parameters for different power classes were discussion in last RAN4 meeting triggered by LS from RAN5 [1]. The corresponding agreements are captured in [2][3]. There are still some open issues to be addressed in RAN4#111 meeting, including the assumption of UE gain difference X and Y, UE gain G,

[1] R5-237837 LS on defining the missing relative angular offsets and UE gain-related parameters for different PC.

[2] R4-2403446 Ad-hoc minutes on Reply LS

[3] R4-2406391 WF on defining the missing testing parameter for PC1/5/6

### Sub-topic 1-1

**Issue 1-1-1: what is the assumption for Gain difference Y and Z between fine beam and rough beam for PC1/5/6？**

What essential for this discussion is the antenna elements to be considered for PC1/PC5/PC6, where the value ever considered are: 32, 16, 16. However, if use such values to define Y/Z in RRM, the gain differences seem to be too tighten, since a good UE may be equipped with even more antenna elements. Larger difference might be needed for PC1/5/6.

* Proposals
  + Proposal 1: (Samsung, Qualcomm, Huawei)
* **Proposal 1: For the gain difference Y and Z between fine beam and rough beam for PC1/5/6, the square brackets can be removed.**
* Table B.2.1.3.1-1: Gain difference Y between fine and rough beams, Rx beam peak direction

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Value "Y" in dB, for each UE power class | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 18 | 9.0 | 7.0 | FFS | 15.5 | 15.5 | FFS |

* Table B.2.1.3.2-1: Gain difference Z between fine and rough beams, Spherical coverage directions

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Value "Z" in dB, for each UE power class | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 18 | 9.0 | 7.0 | FFS | 15.5 | 15.5 | FFS |

* Recommended WF

**Issue 1-1-2: what is the UE gain for PC1/5/6**

* Proposals
  + Proposal 1: (Huawei, Qualcomm)

The Gmin and Gmax for PC 1/5/6 are defined as:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | UE Power class | | | | | |
|  | 1 | 2 | 3 | 4 | 5 | 7 |
| Minimum, dBi | 0 | FFS | -10 | FFS | -5 | FFS |
| Maximum, dBi | 57 | FFS | +20 | FFS | 57 | FFS |

* + Proposal 2: (Samsung)
* Table B.2.1.5.1-1: UE gain G, Rx beam peak direction

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | UE Power class | | | | | | |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Minimum, dBi | -22 | FFS | -10 | FFS | -22 | -22 | FFS |
| Maximum, dBi | +26 | FFS | +20 | FFS | +24 | +24 | FFS |

* + Proposal 2: (Samsung)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | UE Power class | | | | | |
|  | 1 | 2 | 3 | 4 | 5 | 6 |
| Minimum, dBi | 0 | FFS | -10 | FFS | -5 | -5 |
| Maximum, dBi | +29 | FFS | +20 | FFS | +26.5 | +26.5 |

* Recommended WF

**Issue 1-1-3: what is the UE rough beam gain reduction D in Rx beam peak direction for PC 1/5/6?**

The intention of involving D is the relative accuracy TC is that: The Rough Peak beam (Beam 1) is selected based on the Fine beam peak direction, and the coverage rough beam (Beam 2) is selected from the sets for fine coverage rough beam. While there could be misalignment between the rough peak and fine peak. Thus, margin should be considered for beam gain reduction due to this misalignment. For power class 1/5/6 with more antenna elements, the situation could be severer. Since the beam is narrower for PC1/5/6 than PC3, the beam misalignment between fine and rough beam could result

* Proposals
  + Proposal 1: (Huawei)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | UE Power class | | | | | |
|  | 1 | 2 | 3 | 4 | 5 | 6 |
| Maximum gain reduction, dB | 11.5 | FFS | 5.5 | FFS | 8.5 | 8.5 |

* + Proposal 2: (Samsung)

Do not define gain reduction for PC6 and the gain reduction for PC1/5 is as below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | UE Power class | | | | |
|  | 1 | 2 | 3 | 4 | 5 |
| Maximum gain reduction, dB | 10 | FFS | 5.5 | FFS | 10 |

* Recommended WF

**Issue 1-1-4: what is Ginter for PC 1/6?**

Ginter is the margin due to different antenna gain on different bands, which comes from RF transceiver gain difference.

* Proposals
  + Proposal 1: (Samsung)

For UE gain difference between inter-frequencies Ginter, 3dB for PC1 and PC6

* + Proposal 2: (Qualcomm)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | UE Power class | | | | |
|  | 1 | 2 | 3 | 4 | 7 |
| Maximum difference, dB | 3 | FFS | 3 | 3 | FFS |

* + Proposal 3 (Nokia)

For PC 1, 5, and 6, specify UE gain difference between inter-frequencies Ginter equal to 3 dB.

* Recommended WF

**Issue 1-1-5: whether UE gain to PRS-RSRP measurement point for FR2 (Table B.2.1.5.3-1) needs to be defined for PC1, PC5, and PC6?**

* Proposals
  + Proposal 1: (Samsung)

**There is no need to define G gain in Clause 2.1.6 Gain to PRS-RSRP measurement point for FR2 for PC6**

**For the UE gain to PRS-RSRP measurement point for FR2 for PC1/PC5**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | UE Power class | | | | |
|  | 1 | 2 | 3 | 4 | 5 | 7 |
| Minimum, dBi | -22 | FFS | -10 | FFS | -22 | FFS |
| Maximum, dBi | +26 | FFS | +20 | FFS | +24 | FFS |

* + Proposal 1: (Nokia)

**RAN4 not to define UE gain to PRS-RSRP measurement point for FR2 (Clause B.2.1.6) for PC1, PC5, and PC6, unless the need for those is explicitly justified.**

* Recommended WF

**Issue 1-1-6: Minimum SSB\_RP for intra-frequency measurements in FR2**

In the LS, RAN5 is asking for the Minimum SSB\_RP Conditions for NR L1-RSRP reporting. However, for PC6 devices, there is a TC defined not only for L1-RSRP measurements but also for L3-measurements, i.e., A.7.6.1.5 SA event triggered reporting test without gap under non-DRX for UE configured with *highSpeedMeasFlagFR2-r17*. Therefore, the Table B.2.2-2: Conditions for intra-frequency measurements in FR2 may still also need values of Minimum SSB\_RP like L1-RSRP reporting.

* Proposals
  + Proposal 1: (Nokia)

RAN4 to define the values of Minimum SSB\_RP in Table B.2.2-2: Conditions for intra-frequency measurements in FR2 for PC6 devices as shown in the table above and inform RAN5 about the change

Table B.2.2-2: Conditions for intra-frequency measurements in FR2

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Angle of arrival | NR operating bands | Minimum SSB\_RP Note 2, Note 3 | | | | | | | SSB Ês/Iot |
|  |  |  | dBm / SCSSSB | | | | | | | dB |
|  |  |  | SCSSSB = 120 kHz | | | | | | SCSSSB = 240 kHz |  |
|  |  |  | UE Power class | | | | | | UE Power class |  |
|  |  |  | 1 | 2 | 3 | 4 | 5 | 6 | 1, 2, 3, 4, 5, 6 |  |
| Conditions | Rx Beam Peak | n257 | -128.3+Y1 | -113.8 | -112.1 | -127.8+Y4 | -123.4+Y5 | -123.4+Y6 | (Value for SCSSSB = 120 kHz) +3dB | ≥-6 |
|  |  | n258 | -128.3+Y1 | -113.8 | -112.1 | -127.8+Y4 | -123.6+Y5 | -123.6+Y6 |  |  |
|  |  | n259 |  |  | -108.5 |  | -120.5+Y5 |  |  |  |
|  |  | n260 | -125.3+Y1 |  | -109.5 | -125.8+Y4 |  |  |  |  |
|  |  | n261 | -128.3+Y1 | -113.8 | -112.1 | -127.8+Y4 |  | -123.4+Y6 |  |  |
| n262 | -123.3+Y1 | -108,6 | -106.6 | -121.8+Y4 |  |  |
|  | Spherical coverage Note 1 | n257 | -120.3+Z1 | -102.8 | -101.2 | -118.8+Z4 | -115.4+Z5 | -115.4+Z6 | (Value for SCSSSB = 120 kHz) +3dB | ≥-6 |
|  |  | n258 | -120.3+Z1 | -102.8 | -101.2 | -118.8+Z4 | -115.6+Z5 | -115.6+Z6 |  |  |
|  |  | n259 |  |  | -95.7 |  |  |  |  |  |
|  |  | n260 | -117.3+Z1 |  | -96.9 | -113.8+Z4 |  |  |  |  |
|  |  | n261 | -120.3+Z1 | -102.8 | -101.2 | -118.8+Z4 |  | -115.4+Z6 |  |  |
| n262 | -115.1+Z1 | -96.7 | -93.5 | -109.7+Z4 |  |  |
| Note 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.  Note 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.  Note 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by ∆MBP,n and Spherical coverage values are increased by ∆MBS,n, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19]. | | | | | | | | | | | |

**Issue 1-1-7: LS in R4-2408650 agreeable?**

* Proposals
  + Proposal 1: Yes
  + Proposal 2: No, to be revised.
* Recommended WF

**Issue 1-1-8: please provide comments on the following Cat F CRs?**

|  |  |  |  |
| --- | --- | --- | --- |
| [R4-2408652](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408652.zip) | CR to 38.133 Rel-15 CatF on Missing PC1 Test Parameters for RAN5 | Nokia | Suggestion is to be revised |
| [R4-2408656](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408656.zip) | CR to 38.133 Rel-17 CatF on PC5,6 RRM Test Configuration Parameters for RAN5 | Nokia | Suggestion is to be revised |