**3GPP TSG-RAN WG4 Meeting # 107 R4-23XXXXX**

**Incheon, KR, May 22nd – May 26th , 2023**

**Agenda item:** 7.21&7.22

**Source:** Moderator (China Unicom)

**Title:** Topic summary for [107][113] HPUE\_Basket\_FDD

**Document for:** Information

# Introduction

Thread [113] includes the following topics:

1. Topic #1 Issues for (Agenda 7.21)
2. Topic #2 Issues for (Agenda 7.22)

# Topic #1: HPUE for CA with PC2 on FDD carrier

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2307307 | China Unicom | *Revised WID Reserved for post-meeting approval* |
| R4-2307308 | China Unicom | *BigCR Reserved for post-meeting approval* |
| R4-2307309 | China Unicom | *TR Reserved for post-meeting approval* |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

None.

# Topic #2: HPUE for FDD single band

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2307310 | China Unicom | *Revised WID Reserved for post-meeting approval* |
| R4-2307311 | China Unicom | *TR Reserved for post-meeting approval* |
| R4-2307312 | China Unicom | *BigCR Reserved for post-meeting approval* |
| R4-2307313 | China Unicom | TP for TR 38.896 to include n8 PC2 RSD values |
| R4-2307239 | Skyworks Solutions, Inc. | **Proposal on PC2 RSD for n8 25MHz CBW:** * **An RSD value of 2.1dB and 5.6dB can be used for 25MHz CBW for 1Tx and 2Tx RSD respectively.**
* **These RSD values can be captured in the Release 18 RSD tables with a note to clarify applicability to UEs supporting the optional 25MHz DL bandwidths by signalling the associated *channelBWs-UL* IE.**
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| R4-2307061 | Skyworks Solutions, Inc. | **Observations:*** For the difference between n25 and n2 it seems that Huawei’s input may have different assumptions for REFSENS or implementation for n2 versus n25. The difference is more pronounced for the cases where the PC3 REFSENS is without de-sense.
* For the difference between 1TX and 2Tx it seems that Apple’s input may have different assumptions for the corrected 2Tx input than the initial 1Tx input. The issue is present only for the cases where the PC3 REFSENS is without de-sense and the RSD has been corrected. It should be noted that before the correction the issue was worse. Murata input is only slightly on the wrong side for the 5MHz bandwidth.

**Observations:*** For 1Tx, the n25 averaged RSD is equal or slightly lower than the Band n2 averaged RSD
* For 2Tx, the n25 averaged RSD is systematically higher than the Band n2 averaged RSD which is difficult to explain and is skewed by one input.
* Within a 0.1dB rounding error, the 2Tx RSD is higher than the 1Tx RSD as expected
* Averages will have to be re-assessed after understanding some of the differences highlighted in this chapter.

**Observations:*** Although there some outliers where 2Tx RSD is smaller than 1Tx RSD for the CBW where there is no de-sense in the REFSENS value, the averaged values are consistent with 2Tx RSD larger than 1Tx RSD and the same trends versus CBW is observed for all contributions.
* Except for n13 there are a minimum of 3 companies’ inputs and most of the time at least 4. Since n13 has no de-sense for the 5MHz and 10MHz it is not anticipated that the average would be modified significantly with more inputs.
* The averaged values are thus acceptable for all LB.

**Proposal:** * **The difference in assumptions between n2 and n25 and 1Tx and 2Tx RSD is discussed amongst contributing companies to sort issues and potentially correct the calculated averages.**
* **The inputs considered in the WF need to be corrected to account for the exact values contributed by companies for n2 and n25, but also need to be further checked for the other bands.**

**Proposal on RSD for low bands and Band n66: Table 12 and 13 are used for a running CR on PC2 RSD which will be pending completion on the bands requiring PC2 A-MPR evaluation.*** **The calculated averaged values for LB in this contribution is used for the 1Tx and 2Tx RSD**
* **Band n66 RSD is zero as agreed in [1]**
* **Band n71 RSD for symmetrical UL/DL is based on [3] (blue highlight) and may be reviewed based on additional contributions and agreements in the adding new CBW AI and is given for information**
* **Band n8 25MHz DL/20MHz UL is based on [2] (yellow highlight) and may be reviewed based on additional contributions and agreements and is given for information.**

**Table 12:** **Reference Sensitivity Degradation from PC3 to PC2 for n71 for UE not supporting Tx Diversity**

| Operating Band | 5MHz(dB) | 10MHz(dB) | 15MHz(dB) | 20MHz(dB) | 25MHz(dB) | 30 MHz (dB) | 35 MHz (dB) | 40MHz(dB) | 45 MHz (dB) | 50MHz(dB) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| n5 | 0.5 | 0.8 | 0.8 | 2.5 | 2.8 | - | - | - | - | - |
| n8 | 0.6 | 0.8 | 0.8 | 2.3 | [2.1] | - | 3.2 | - | - | - |
| n13 | 0.9 | 0.9 | - | - | - | - | - | - | - | - |
| n26 | 0.6 | 0.7 | 0.8 | 2.3 | 2.6 | 2.9 | - | - | - | - |
| n28 | 0.7 | 0.6 | 0.7 | 1.3 | 2.6 | 3.1 | - | - | - | - |
| n66 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - |
| n71 | 0.5  | 1.0 | 0.9 | 2.3 | 2.4[2.82] | 2.5[3.02] | 2.9[3.02] | - | - | - |
| n85 | 0.6 | 1.0 | 2.6 | - | - | - | - | - | - | - |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4NOTE 2: UEs supporting the optional symmetrical UL/DL bandwidths shall meet this requirement |

Table 13: Reference Sensitivity Degradation from PC3 to PC2 for n71 for UE supporting Tx Diversity

| Operating Band | 5MHz(dB) | 10MHz(dB) | 15MHz(dB) | 20MHz(dB) | 25MHz(dB) | 30 MHz (dB) | 35 MHz (dB) | 40MHz(dB) | 45 MHz (dB) | 50MHz(dB) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| n5 | 1.2 | 1.3 | 1.6 | 5.7 | 6.2 | - | - | - | - | - |
| n8 | 1.4 | 1.5 | 2.2 | 5.9 | [5.6] | - | 7.0 | - | - | - |
| n13 | 1.9 | 1.9 | - | - | - | - | - | - | - | - |
| n26 | 1.2 | 1.2 | 1.5 | 5.2 | 6.1 | 6.6 | - | - | - | - |
| n28 | 1.1 | 1.2 | 1.4 | 3.1 | 6.6 | 7.8 | - | - | - | - |
| n66 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - |
| n71 | 1.2  | 1.3  | 1.9  | 5.5 | 5.9[5.92] | 6.2 [6.12] | 6.5[6.12] | - | - | - |
| n85 | 1.4 | 1.5 | 6.5 | - | - | - | - | - | - | - |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2G.4NOTE 2: UEs supporting the optional symmetrical UL/DL bandwidths shall meet this requirement |

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| R4-2307059 | Skyworks Solutions, Inc. | **Observation:** In the “Adding new channel BWs support to existing NR bands”, the following handling proposal is made: Since PC2 RSD is on top of PC3 REFSENS that must be agreed upon in the “Adding new channel BWs support to existing NR bands” WI, we propose to agree PC3 REFSENS and PC2 RSD in the “Adding new channel BWs support to existing NR bands” WI to avoid the “chicken and egg” issue. The agreements can be captured in the respective BigCRs.**Observation:** In the “Adding new channel BWs support to existing NR bands”, the following proposal on PC2 1Tx and 2Tx RSDs is presented:* 1Tx and 2Tx RSDs for the symmetrical UL/DL 25, 30 and 35MHz CBW are specified in Table 5 and Table 6 below (yellow highlight). Other requirements are in brackets and correspond to the average of proposals. These need to be formally agreed in the related PC2 FDD WI (blue highlight).
* Notes are added to clarify applicability to UEs supporting the optional symmetrical UL/DL bandwidths by signaling the associated *channelBWs-UL* IE.
* 35MHz RSDs shall not be captured in 38.101-1, until this new CBW is formally approved in RAN.
* Note that RSD is on top of REFSENS, thus RSD may need to be recalculated if the agreed REFSENS is different from the one proposed in this contribution.

**Table 5:** **Reference Sensitivity Degradation from PC3 to PC2 for n71 for UE not supporting Tx Diversity**

| Operating Band | 5MHz(dB) | 10MHz(dB) | 15MHz(dB) | 20MHz(dB) | 25MHz(dB) | 30 MHz (dB) | 35 MHz (dB) | 40MHz(dB) | 45 MHz (dB) | 50MHz(dB) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| n71 | [0.5]  | [0.9]  | [0.9]  | [2.2]  | [2.4] 2.82 | [2.5] 3.02 | [2.9] [3.02] | - | - |  - |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4NOTE 2: UEs supporting the optional symmetrical UL/DL bandwidths shall meet this requirement |

Table 6: Reference Sensitivity Degradation from PC3 to PC2 for n71 for UE supporting Tx Diversity

| Operating Band | 5MHz(dB) | 10MHz(dB) | 15MHz(dB) | 20MHz(dB) | 25MHz(dB) | 30 MHz (dB) | 35 MHz (dB) | 40MHz(dB) | 45 MHz (dB) | 50MHz(dB) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| n71 | [1.1  | [1.1  | [1.7]  | [5.5]  | [5.9] 5.92 | [6.2] 6.12 | [6.5] [6.12] | - | - | - |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2G.4NOTE 2: UEs supporting the optional symmetrical UL/DL bandwidths shall meet this requirement |

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| R4- 2307916 | Huawei, HiSilicon | **Proposal 1:** It’s proposed to set PC2 1Tx MSD=3.4dB and 2Tx MSD=6.5dB for 25MHz BW for band n8. |
| R4- 2307917 | Huawei, HiSilicon, China Unicom | TP for TR 38.896 on the A-MPR requirements for band n8 |
| R4- 2307918 | Huawei, HiSilicon | TP for TR 38.896 on the A-MPR requirements for band n28 |
| R4-2309059 | Apple Inc. | **Proposal 1:** For 5MHz channel bandwidth apply the A-MPR provided in Table 2.**Proposal 2:** Apply A-MPR regions and MPR from Table 3 and Table 4 for 10MHz channel bandwidth.**Proposal 3:** Apply A-MPR regions and MPR from Table 5 and Table 6 for 15MHz channel bandwidth. |
| R4-2309060 | Apple Inc. | **Proposal 1:** For 5MHz channel bandwidth apply the A-MPR provided in Table 2 (same values as proposed in R4-2304519).**Proposal 2:** Apply A-MPR regions and MPR from Table 3 for 10MHz, 15MHz and 20MHz channel bandwidth (same values as proposed in R4-2304519).**Proposal 3:** Apply A-MPR regions and MPR from Table 5 and Table 6 for 25MHz and 30MHz channel bandwidth |
| R4-2308436 | Murata Manufacturing Co Ltd. | **Proposal:** The REFSENS of PC3 and RSD of PC2 are proposed in bold in Table 2.Table 2. REFSENS for PC3 and RSD for PC2

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **UL/DL = 20/25MHz** |
| PC3 | Scaling REFSENS | dBm | -89.7 |
| Desense | dB | 5.4 |
| MRC REFSENS | dBm | **-84.4** |
| PC2 | RSD 1Tx | dB | **2.8** |
| RSD 2Tx | dB | **6.1** |

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## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1 Receiver Sensitivity Degradation

*Sub-topic description:*

*Open issues and candidate options before meeting:*

**Issue 2-1-1: RSD for n8 PC2 on 25MHz CBW**

* Proposal 1:

| Operating Band | Source | 1Tx(dB) | 2Tx(dB) |
| --- | --- | --- | --- |
| n8-25MHz | Skyworks (R4-2307239) | 2.1 | 5.6 |
|  Huawei, HiSilicon (R4-2307916) | 3.4 | 6.5 |
| Murata (R4-2308436) | 2.8 | 6.1 |
| Average | 2.8 | 6.1 |

* Proposal 2: **These RSD values can be captured in the Release 18 RSD tables with a note to clarify applicability to UEs supporting the optional 25MHz DL bandwidths by signalling the associated *channelBWs-UL* IE.** (R4-2307239)
* Recommended WF
	+ TBA

**Issue 2-1-2: TP for TR38.896 on capturing RSD for n8 PC2**

* Proposals: **TP for TR 38.896 to include n8 PC2 RSD values, as captured in WF last meeting.** (R4-2307313)
* Recommended WF
	+ TBA

**Issue 2-1-3: RSD for n2 and n25 PC2**

* Proposals: **The difference in assumptions between n2 and n25 and 1Tx and 2Tx RSD is discussed amongst contributing companies to sort issues and potentially correct the calculated averages.** (R4-2307061)
* Recommended WF
	+ TBA

**Issue 2-1-4: n71 PC2 RSD for 25, 30 and 35MHz symmetrical ULDL CBW**

* Proposals: **Table 5 and Table 6 as provided in R4-2307059 for information.**
* Recommended WF
	+ The formal discussion is expected to be carried out in adding new CBW AI (10.26).

### Sub-topic 2-2 A-MPR

*Sub-topic description*

*Open issues and candidate options before meeting:*

**Issue 2-2-1: PC2 A-MPR for band n8**

* Proposals

**Proposal 1: For NS\_43 PC2 1Tx BW=5MHz, modify the A-MPR values for A1 as follows:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Option 1 (R4- 2304518, Huawei, HiSilicon)** |

|  |  |
| --- | --- |
| **Modulation/Waveform** | **A1 (dB)** |
|  | **Outer** | **Inner** |
| DFT-s-OFDM | Pi/2 BPSK | [1] | N/A |
|  | QPSK | ≤ [2+1] |  |
|  | 16 QAM | ≤ [3] |  |
|  | 64 QAM | ≤ [3] |  |
|  | 256 QAM |  |  |
| CP-OFDM | QPSK | ≤ [3.5+0.5] |  |
|  | 16 QAM | ≤ [3.5+0.5] |  |
|  | 64 QAM | ≤ [4] |  |
|  | 256 QAM |  |  |

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| **Option 2 (R4-2309059, Apple)** |

|  |  |
| --- | --- |
| **Modulation/Waveform** | **A1 (dB)** |
|  | **Outer** | **Inner** |
| DFT-s-OFDM | Pi/2 BPSK | 1.0 | N/A |
|  | QPSK | ≤ 3.5 |  |
|  | 16 QAM | ≤ 3.5 |  |
|  | 64 QAM | ≤ 3.5 |  |
|  | 256 QAM | ≤ 4.5 |  |
| CP-OFDM | QPSK | ≤ 4.0 |  |
|  | 16 QAM | ≤ 4.0 |  |
|  | 64 QAM | ≤ 4.0 |  |
|  | 256 QAM | ≤ 6.5 |  |

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**Proposal 2: For NS\_43 PC2 1Tx BW=10MHz, modify the A-MPR values for A2, A3, A4 and A5 as follows:**

**Region:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Channel Bandwidth (MHz)** | **Carrier Centre Frequency, Fc (MHz)** | **Region A** | **Region B** |
|  |  | **RBstart** | **LCRB** | **A-MPR** | **RBstart** | **LCRB** | **A-MPR** |
| 10 MHz | FC = 910 |  | > 7.2 MHz/12/SCS | A2 |  | > 5.4 MHz/12/SCS | A4 |
|  |  |  | > 8.1 MHz/12/SCS | A3 |  | > 7.2 MHz/12/SCS | A5 |
| NOTE 1: The A-MPR values are specified in Table 6.2.3.6-2.NOTE 2: Only 15 kHz SCS is applicable for power class 3; both 15kHz and 30kHz SCS are applicable for power class 2.NOTE 3: Void |

**Values:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Option 1 (R4- 2304518, Huawei, HiSilicon)** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Modulation/Waveform** | **A2 (dB)** | **A3 (dB)** | **A4 (dB)** | **A5 (dB)** |
|  | **Outer** | **Inner** | **Outer** | **Inner** | **Outer** | **Inner** | **Outer** | **Inner** |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 1.5 | N/A |  |  |  | N/A |  | N/A |
|  | QPSK |  |  |  |  | ≤ [2.5+3] |  |  |  |
|  | 16 QAM |  |  |  |  |  |  | ≤ [2.5+2.5] |  |
|  | 64 QAM |  |  | ≤ [2.5+2.5] |  |  |  |  |  |
|  | 256 QAM |  |  |  |  |  |  |  |  |
| CP-OFDM | QPSK |  |  |  |  |  |  | ≤ [4+2] |  |
|  | 16 QAM |  |  |  |  |  |  | ≤ [4+2.5] |  |
|  | 64 QAM |  |  | ≤ [4+2] |  |  |  |  |  |
|  | 256 QAM |  |  |  |  |  |  |  |  |

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| **Option 2 (R4-2309059, Apple)** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Modulation/Waveform** | **A2 (dB)** | **A3 (dB)** | **A4 (dB)** | **A5 (dB)** |
|  | **Outer** | **Inner** | **Outer** | **Inner** | **Outer** | **Inner** | **Outer** | **Inner** |
| DFT-s-OFDM | Pi/2 BPSK | ≤ [1.5] | N/A |  |  |  | N/A |  | N/A |
|  | QPSK |  |  |  |  | ≤ [3.5] |  | ≤ [5] |  |
|  | 16 QAM |  |  |  |  | ≤ [3.5] |  | ≤ [5] |  |
|  | 64 QAM | ≤ [4.5] |  | ≤ [5] |  |  |  |  |  |
|  | 256 QAM |  |  |  |  |  |  |  |  |
| CP-OFDM | QPSK |  |  |  |  | ≤ [4] |  | ≤ [6] |  |
|  | 16 QAM |  |  |  |  | ≤ [4.5] |  | ≤ [6] |  |
|  | 64 QAM | ≤ [5] |  | ≤ [6.5] |  |  |  |  |  |
|  | 256 QAM |  |  |  |  |  |  |  |  |

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**Proposal 3: For NS\_43 PC2 1Tx BW=15MHz, modify the A-MPR values for A6 as follows:**

**Issue 1: Region**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Option 1 (R4- 2304518, Huawei, HiSilicon)** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Channel Bandwidth (MHz)** | **Carrier Centre Frequency, Fc (MHz)** | **Region A** | **Region B** |
|  |  | **RBstart** | **LCRB** | **A-MPR** | **RBstart** | **LCRB** | **A-MPR** |
| 15 MHz | FC = 907.5 | ≤ 1.8 MHz /12/SCS> 12.24 MHz/12/SCS | > 0 | A6 | > 1.8 MHz/12/SCS< 6.12 MHz/12/SCS | ≥ 7.2 MHz/12/SCS | A6 |
|  |  |  | > 1.8 MHz/12/SCS< 6.12 MHz/12/SCS | < 7.2 MHz/12/SCS | A7 |
|  |  |  | ≥ 1.8 MHz/12/SCS≤ 7.2 MHz/12/SCS | > 5.4 MHz/12/SCS | A7 |

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| **Option 2 (R4-2309059, Apple)** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Channel Bandwidth (MHz)** | **Carrier Centre Frequency, Fc (MHz)** | **Region A** | **Region B** |
|  |  | **RBstart** | **LCRB** | **A-MPR** | **RBstart** | **LCRB** | **A-MPR** |
| 15 MHz | FC = 907.5 | ≤ 1.8 MHz /12/SCS~~> 12.24 MHz/12/SCS~~ |  | A6 | > 1.8 MHz/12/SCS< 6.12 MHz/12/SCS | ≥ 7.2 MHz/12/SCS | A6 |
| ≥ 12.24 MHz/12/SCS | > 0 | A6 | > 1.8 MHz/12/SCS< 6.12 MHz/12/SCS | < 7.2 MHz/12/SCS | A7 |
|  |  |  | ≥ ~~1.8~~ 6.12 MHz/12/SCS≤ 7.2 MHz/12/SCS | > 5.4 MHz/12/SCS | A7 |

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**Issue 2: Values**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Option 1 (R4- 2304518, Huawei, HiSilicon)** |

|  |  |  |
| --- | --- | --- |
| **Modulation/Waveform** | **A6** | **A7** |
|  | **Outer /****Inner (dB)** | **Outer (dB)** | **Inner (dB)** |
| DFT-s-OFDM | Pi/2 BPSK | ≤ [9+3] | ≤ [4] | [3] |
|  | QPSK | ≤ [9+3] | ≤ [4] | [3] |
|  | 16 QAM | ≤ [9+3] | ≤ [5] | [4] |
|  | 64 QAM | ≤ [9+3] | ≤ [5.5] | [5.5] |
|  | 256 QAM | ≤ [9+3] | ≤ [6.5] | [5.5] |
| CP-OFDM | QPSK | ≤ [9+3] | ≤ [6] | [4.5] |
|  | 16 QAM | ≤ [9+3] | ≤ [6] | [5] |
|  | 64 QAM | ≤ [9+3] | ≤ [6.5] | [6] |
|  | 256 QAM | ≤ [9+3] | ≤ [7] | [7] |

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| **Option 2 (R4-2309059, Apple)** |

|  |  |  |
| --- | --- | --- |
| **Modulation/Waveform** | **A6** | **A7** |
|  | **Outer /****Inner (dB)** | **Outer (dB)** | **Inner (dB)** |
| DFT-s-OFDM | Pi/2 BPSK | ≤ [12] | ≤ [4] | [3] |
|  | QPSK | ≤ [12] | ≤ [4] | [3] |
|  | 16 QAM | ≤ [12] | ≤ [5] | [4] |
|  | 64 QAM | ≤ [12] | ≤ [5.5] | [5.5] |
|  | 256 QAM | ≤ [12] | ≤ [6.5] | [5.5] |
| CP-OFDM | QPSK | ≤ [12] | ≤ [6] | [4.5] |
|  | 16 QAM | ≤ [12] | ≤ [6] | [5] |
|  | 64 QAM | ≤ [12] | ≤ [6.5] | [6] |
|  | 256 QAM | ≤ [12] | ≤ [7] | [7] |

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* Recommended WF
	+ TBA

**Issue 2-2-2: PC2 A-MPR for band n28**

* Proposals

**Proposal 1: For NS\_18 PC2 1Tx BW=5MHz, modify the A-MPR values for A1 as follows:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Option 1 (R4- 2304519, Huawei, HiSilicon)** |

|  |  |
| --- | --- |
| **Modulation/Waveform** | **A1 (dB)** |
|  | **Outer** |
| DFT-s-OFDM | Pi/2 BPSK | ≤ [2+1] |
|  | QPSK | ≤ [2+1] |
|  | 16 QAM | ≤ [3+1] |
|  | 64 QAM | ≤ [4+0.5] |
|  | 256 QAM | ≤ [6] |
| CP-OFDM | QPSK | ≤ [5] |
|  | 16 QAM | ≤ [5] |
|  | 64 QAM | ≤ [5.5] |
|  | 256 QAM | ≤ [8.5] |

 |
| **Option 2 (R4-2309060, Apple)** |

|  |  |
| --- | --- |
| **Modulation/Waveform** | **A1 (dB)** |
|  | **Outer** |
| DFT-s-OFDM | Pi/2 BPSK | ≤ [3.5] |
|  | QPSK | ≤ [3.5] |
|  | 16 QAM | ≤ [4.0] |
|  | 64 QAM | ≤ [4.5] |
|  | 256 QAM | ≤ [6.5] |
| CP-OFDM | QPSK | ≤ [5.5] |
|  | 16 QAM | ≤ [5.5] |
|  | 64 QAM | ≤ [6.0] |
|  | 256 QAM | ≤ [9.0] |

 |

**Proposal 2: For NS\_18 PC2 1Tx BW=10/15/20MHz, modify the A-MPR values for A2 as follows:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Option 1 (R4- 2304519, Huawei, HiSilicon)****&****Option 2 (R4-2309060, Apple)** |

|  |  |
| --- | --- |
| **Modulation/Waveform** | **A2 (dB)** |
|  | **Inner/Outer** |
| DFT-s-OFDM | Pi/2 BPSK | ≤ [5+3] |
|  | QPSK | ≤ [5+3] |
|  | 16 QAM | ≤ [6+3] |
|  | 64 QAM | ≤ [7+3] |
|  | 256 QAM | ≤ [9+2] |
| CP-OFDM | QPSK | ≤ [6.5+3] |
|  | 16 QAM | ≤ [7+3] |
|  | 64 QAM | ≤ [8.5+3] |
|  | 256 QAM | ≤ [11.5] |

 |

**Proposal 3: For NS\_18 PC2 1Tx BW=25/30MHz, modify the A-MPR values for A3/A4/A5 as follows:**

**Issue 1: Region**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Option 1 (R4- 2304519, Huawei, HiSilicon)** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Channel Bandwidth, MHz** | **Frequency range of UL transmission bandwidth configuration, MHz** | **Regions** | **A-MPR** |
|  |  | **RBstart\*12\*SCS****MHz** | **LCRB\*12\*SCS****MHz** |  |
| 25 | 703~733 | >(LCRB\*12\*SCS)/2+3.6 | ≥Max(0, 12\*SCS\*NRB – 1.8 – RBstart\*12\*SCS) | A3 |
|  |  | ≤(LCRB\*12\*SCS)/2+3.6 | ≥5.4 | A4 |
|  |  | ≤6.3 | <5.4 | A5 |
| 30 | 703~733 | >(LCRB\*12\*SCS)/2+5.22 | ≥Max(0, 12\*SCS\*NRB – 1.8 – RBstart\*12\*SCS) | A3 |
|  |  | ≤(LCRB\*12\*SCS)/2+5.22 | ≥5.4 | A4 |
|  |  | ≤7.92 | <5.4 | A5 |

 |
| **Option 2 (R4-2309060, Apple)** |

|  |  |  |  |
| --- | --- | --- | --- |
| Channel Bandwidth, MHz | Frequency range of UL transmission bandwidth configuration, MHz | Regions (PC2) | A-MPR |
|  |  | RBstart\*12\*SCSMHz | LCRB\*12\*SCSMHz |  |
| 25 | 703~733 | >(LCRB\*12\*SCS)/2+3.6 | ≥Max(0, 12\*SCS\*NRB – 1.8 – RBstart\*12\*SCS) | A3 |
|  |  | ≤(LCRB\*12\*SCS)/2+3.6 | ≥5.4 | A4 |
|  |  | ≤6.3 | <5.4 | A5 |
|  |  | >(LCRB\*12\*SCS)/2+3.6≤(LCRB\*12\*SCS)/2+5.76 | <Max(0, 12\*SCS\*NRB – 1.8 – RBstart\*12\*SCS)≥5.4 | A6 |
| 30 | 703~733 | >(LCRB\*12\*SCS)/2+5.22 | ≥Max(0, 12\*SCS\*NRB – 1.8 – RBstart\*12\*SCS) | A3 |
|  |  | ≤(LCRB\*12\*SCS)/2+5.22 | ≥5.4 | A4 |
|  |  | ≤7.92 | <5.4 | A5 |
|  |  | >(LCRB\*12\*SCS)/2+5.22≤(LCRB\*12\*SCS)/2+7.38 | <Max(0, 12\*SCS\*NRB – 1.8 – RBstart\*12\*SCS)≥5.4 | A6 |

 |

**Issue 2: Values**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Option 1 (R4- 2304519, Huawei, HiSilicon)** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Modulation/Waveform** | **A3 (dB)** | **A4 (dB)** | **A5 (dB)** |
|  | **Outer/Inner** | **Outer/Inner** | **Outer/Inner** |
| DFT-s-OFDM | Pi/2 BPSK | [3+0.5] | [8+2] | [3+1.5] |
|  | QPSK | [3+0.5] | [8+2] | [3+1.5] |
|  | 16 QAM | [3+0.5] | [8+3] | [3+2] |
|  | 64 QAM | [3+0.5] | [8+3] | [4.5+1] |
|  | 256 QAM | [3+0.5] | [8+3] | [5.5] |
| CP-OFDM | QPSK | [4.5+0.5] | [9.5+2] | [5+1] |
|  | 16 QAM | [4.5+0.5] | [9.5+2] | [5+1] |
|  | 64 QAM | [4.5+0.5] | [9.5+2] | [5.5+0.5] |
|  | 256 QAM | [4.5+0.5] | [9.5+2] | [7.5] |

 |
| **Option 2 (R4-2309060, Apple)** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Modulation/Waveform** | **A3 (dB)** | **A4 (dB)** | **A5 (dB)** | **A6 (dB)** |
|  | **Outer/Inner** | **Outer/Inner** | **Outer/Inner** | **Outer/Inner** |
| DFT-s-OFDM | Pi/2 BPSK | [3+0.5] | [8+2] | [3+1.5] | [0+2.0] |
|  | QPSK | [3+0.5] | [8+2] | [3+1.5] | [0+2.0] |
|  | 16 QAM | [3+0.5] | [8+3] | [3+2] | [1.0+1.0] |
|  | 64 QAM | [3+0.5] | [8+3] | [4.5+1] | [2.5] |
|  | 256 QAM | [3+0.5] | [8+3] | [5.5] | [4.5] |
| CP-OFDM | QPSK | [4.5+0.5] | [9.5+2] | [5+1] | [1.5+2.5] |
|  | 16 QAM | [4.5+0.5] | [9.5+2] | [5+1] | [2.0+2.0] |
|  | 64 QAM | [4.5+0.5] | [9.5+2] | [5.5+0.5] | [3.5+0.5] |
|  | 256 QAM | [4.5+0.5] | [9.5+2] | [7.5] | [6.5] |

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* Recommended WF
	+ TBA

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