**3GPP TSG-RAN WG4 Meeting # 104-bis-e R4-22XXXXX**

**Electronic Meeting, 10– 19 October 2022**

**Agenda item:** 5.20, 5.22

**Source:** Moderator (China Unicom)

**Title:** Email discussion summary for [104-bis-e][116] HPUE\_Basket\_FDD

**Document for:** Information

# Introduction

Thread [115] includes the following topics:

1. Topic #1 Issues for (Agenda 5.20)
2. Topic #2 Issues for (Agenda 5.22)

It is appreciated that the delegates for this topic put their contact information in the table below.

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
|  |  |  |

Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)

# Topic #1: 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** |
| R4-2215852 | China Unicom | TR 38.xxx v0.0.1 HPUE\_NR\_FR1\_FDD\_R18 - TR Skeleton |
| R4-2215331 | Skyworks Solutions, Inc. | **Proposal on architecture:*** Only 1Tx architectures are specified for PC2 low bands n5, n8, n13, n26, n28, n71 and n85.
* Only 1Tx Reference sensitivity degradation is specified.
* A-MPR is based on 1Tx PC2 without RIMD contribution.

**Proposal on MSD:*** Reference Sensitivity Degradation from PC3 to PC2 must be assessed for CBW >15MHz for band n5, n26 and n28 and 15MHz CBW crosschecked
* Reference Sensitivity Degradation from PC3 to PC2 must be assessed for CBW >10MHz for band n8, n71 and n85 and 10MHz CBW crosschecked
* Reference Sensitivity Degradation from PC3 to PC2 10MHz CBW should be crosschecked for n13
* Same UL configuration than PC3 is used for PC2.

**Proposal on NS for requested low bands:*** NS\_100 PC3 A-MPR is used for PC2 and accounts for both 1TX and 2TX implementations
* NS\_06/07 A-MPR is specified for PC2 in bands n13, n85
* NS\_12/13/14/15 A-MPR is specified for PC2 in band n26
* NS\_17/18 A-MPR is specified for PC2 in band n28
* NS\_35 A-MPR is specified for PC2 in band n71
* NS\_43/343U A-MPR is specified for PC2 in band n8
* For NS requiring modified SEM close to the channel edge, the edge allocations may require further attention for PC2.

**Proposal on NS\_06/07 1Tx PC2 A-MPR:*** Edge allocations must be checked to account for WOLA spectrum 0-0.1MHz region for both n13 and n85
* PC2 Inner/outer A-MPR for NS\_07 is checked by reusing PC3 A-MPR regions and increasing PC3 back-off by 1dB.

**Proposal on NS\_12/13/14/15 1Tx PC2 A-MPR:** PC2 Inner/outer A-MPR is checked by reusing PC3 A-MPR regions and increasing PC3 back-off by 1dB.**Proposal on NS\_17/18 1Tx PC2 A-MPR:*** For PC2 NS17 emission level, it should be checked to determine whether MPR is sufficient
* PC2 Inner/outer A-MPR for NS\_18 is checked by reusing PC3 A-MPR regions and increasing PC3 back-off by 1dB.

**Proposal on NS\_35 1Tx PC2 A-MPR:** Edge allocations must be checked to account for WOLA spectrum 0-0.1MHz region for n71.**Proposal on NS\_43/43U 1Tx PC2 A-MPR:** PC2 inner/outer A-MPR is checked by reusing PC3 A-MPR regions and increasing PC3 back-off by 1dB. |
| R4-2215332 | Skyworks Solutions, Inc. | **Proposal on architecture:*** Both 1Tx and 2Tx architectures are specified for mid bands n2, n25 and n66
* Both 1Tx and 2Tx PC2 Reference sensitivity degradations are specified
* A-MPR is based on the worst-case architecture which is 2Tx due to lower PA linearity and RIMD contribution.

**Proposal on MSD:*** n66 Reference Sensitivity Degradation from PC3 to PC2 is 0dB for both 1Tx and 2Tx
* n2 and n25 Reference Sensitivity Degradation should be assessed for PC2 1Tx and 2Tx for CBW >25MHz for UL and its image IMD order <9 and potentially checked at 25MHz for IMD9
* Same UL configuration than PC3 is used for PC2.

**Proposal on applicable NS:*** NS\_100 PC3 A-MPR is used for PC2 and accounts for both 1Tx and 2Tx implementations
* NS\_03/03U A-MPR is specified for PC2 n2, n25 and n66. Since this requires a modified SEM mask in the first 1MHz, edge allocations may require further attention for PC2.

**Proposal on NS\_03/03U PC2 A-MPR:*** Edge allocations must be checked to account for WOLA spectrum in the -13dBm/MHz region at >1MHz ΔfOOB
* A-MPR for outer is based on 2Tx PC3 A-MPR+[1dB].
 |
| R4-2215661 | Apple | **Proposal:** RAN4 to take the MSD values in Table 2-1 into consideration for n2, n5, n8, n25, n26, n28, n71, n85 2Tx PC2 MSD relative to PC3 REFSENS. |
| R4-2215893 | ZTE Corporation, China Unicom | **Proposal:** The RSD for all the supported channel bandwidths for PC2 n8 with 2Tx implementation, which is shown in table 4. |
| R4-2216124 | vivo | **Proposal 1:** The maximum out power and tolerance of PC2 UE in new FDD bands is proposed to follow legacy PC2 RF requirement.**Proposal 2:** For band n8, n25, n26, n28 and n85, the extra relaxation is needed on the band edge.**Proposal 3:** The maximum out power and tolerance of PC2 UE in new FDD bands is proposed as the following table: |
| R4- 2216774 | Huawei, HiSilicon | **Proposal 1:** Reuse the Rel-17 methodology and RF assumptions [2] to evaluate A-MPR and MSD requirements for the requested FDD bands.**Proposal 2:** Companies are encouraged to share the evaluation results for interested band(s), which can be captured in the TR via TPs. The RF requirements for the given band(s) are determined after reasonable amount of data is accumulated. |

## Open issues summary

### Sub-topic 1-1 TR Skeleton

**Issue 1-1: TR Skeleton**

* Proposal: TR Skeleton in R4-2215852.
* Recommended WF
	+ TBA

### Sub-topic 1-2 Transmit power & Tolerance

**Issue 1-2-1: Transmit power & Tolerance**

* Proposal: The maximum out power and tolerance of PC2 UE in new FDD bands is proposed to follow legacy PC2 RF requirement. For band n8, n25, n26, n28 and n85, the extra relaxation is needed on the band edge.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NRband | Class 1 (dBm) | Tolerance (dB) | Class 1.5 (dBm) | Tolerance (dB) | Class 2 (dBm) | Tolerance (dB) |
| n5 |  |  |  |  | 26 | +2/-3 |
| n8 |  |  |  |  | 26 | +2/-33 |
| n25 |  |  |  |  | 26 | +2/-33 |
| n26 |  |  |  |  | 26 | +2/-33 |
| n28 |  |  |  |  | 26 | +2/-33 |
| n66 |  |  |  |  | 26 | +2/-3 |
| n71 |  |  |  |  | 26 | +2/-3 |
| n85 |  |  |  |  | 26 | +2/-33 |

* Recommended WF
	+ TBA

### Sub-topic 1-3 A-MPR

**Issue 1-3-1: A-MPR**

* Proposal 1: **NS\_100** PC3 A-MPR is used for PC2 and accounts for both 1TX and 2TX implementations.
* Proposal 2: **NS\_06/07** A-MPR is specified for PC2 in bands n13, n85. Edge allocations must be checked to account for WOLA spectrum 0-0.1MHz region for both n13 and n85. PC2 Inner/outer A-MPR for NS\_07 is checked by reusing PC3 A-MPR regions and increasing PC3 back-off by 1dB.
* Proposal 3: **NS\_12/13/14/15** A-MPR is specified for PC2 in band n26. PC2 Inner/outer A-MPR is checked by reusing PC3 A-MPR regions and increasing PC3 back-off by 1dB.
* Proposal 4: **NS\_17/18** A-MPR is specified for PC2 in band n28. For PC2 NS17 emission level, it should be checked to determine whether MPR is sufficient. PC2 Inner/outer A-MPR for NS\_18 is checked by reusing PC3 A-MPR regions and increasing PC3 back-off by 1dB.
* Proposal 5: **NS\_35** A-MPR is specified for PC2 in band n71. Edge allocations must be checked to account for WOLA spectrum 0-0.1MHz region for n71.
* Proposal 6: **NS\_43/343U** A-MPR is specified for PC2 in band n8. PC2 inner/outer A-MPR is checked by reusing PC3 A-MPR regions and increasing PC3 back-off by 1dB.
* Proposal 7: **NS\_03/03U** A-MPR is specified for PC2 n2, n25 and n66. Since this requires a modified SEM mask in the first 1MHz, edge allocations may require further attention for PC2. Edge allocations must be checked to account for WOLA spectrum in the -13dBm/MHz region at >1MHz ΔfOOB. A-MPR for outer is based on 2Tx PC3 A-MPR+[1dB].
* Recommended WF
	+ TBA

### Sub-topic 1-4 Receiver Sensitivity Degradation

**Issue 1-4: Receiver Sensitivity Degradation for 2Tx**

* Proposal 1: (R4-2215661 - Apple)

|  |  |
| --- | --- |
| **Band** | **Channel BW (MHz) / MSD (dB)** |
| **5** | **10** | **15** | **20** | **25** | **30** | **35** | **40** | **45** | **50** |
| n2 | 0 | 0 | 0 | 0 | 0.2 | 6.7 | 6.6 | 7.3 | N/A | N/A |
| n5 | 0 | 0 | 0 | 6.2 | 6.8 | N/A | N/A | N/A | N/A | N/A |
| n8 | 0 | 0 | 0.9 | 6.2 | N/A | N/A | 8.1 | N/A | N/A | N/A |
| n25 | 0 | 0 | 0 | 0 | 0.1 | 6.9 | 6.8 | 7.5 | 7.9 | N/A |
| n26 | 0 | 0 | 0 | 5.0 | 6.7 | 7.5 | N/A | N/A | N/A | N/A |
| n28 | 0 | 0 | 0 | 2.1 | 7.3 | 8.4 | N/A | N/A | N/A | N/A |
| n71 | 0 | 0 | 1.0 | 6.2 | 6.7 | 7.1 | 7.5 | N/A | N/A | N/A |
| n85 | 0 | 0 | 7.6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

* Proposal 2: (R4-2215893 - ZTE Corporation, China Unicom)

| 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) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| n8 | 0.5 | 0.6 | 1.2 | 5.0 | - | - | 6.7 | - | - | - |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2G.4 |

* Recommended WF
	+ TBA

### Sub-topic 1-5 UE Architecture

**Issue 1-5: UE Architecture**

* Proposal: Only 1Tx architectures are specified for PC2 low bands n5, n8, n13, n26, n28, n71 and n85. Both 1Tx and 2Tx architectures are specified for mid bands n2, n25 and n66.
* Recommended WF
	+ TBA

### Sub-topic 1-6 Requirements Evaluation

**Issue 1-5: Requirements Evaluation**

* Proposal 1: Reuse the Rel-17 methodology and RF assumptions [2] to evaluate A-MPR and MSD requirements for the requested FDD bands.

<Moderator Note: [2] R4-2119946 WF on NR FDD PC2 HPUE, China Unicom, RAN4#101-e>

* Proposal 2: Companies are encouraged to share the evaluation results for interested band(s), which can be captured in the TR via TPs. The RF requirements for the given band(s) are determined after reasonable amount of data is accumulated.
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

Sub topic 1-1 TR Skeleton

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | Fine with the TR Skeleton. |

Sub topic 1-2 Transmit power & Tolerance

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | For band n28, there is no MOP tolerance at the band edge for PC3, why there are MOP tolerance for PC2? For n28, dual duplexer would be used, it may not compliance to the criteria of relative duplex distance of FDD band is less than 1.75%. So we think PC2 and PC3 should keep consistency. |

Sub topic 1-3 A-MPR

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-4 Receiver Sensitivity Degradation

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | This is somehow related to the issue 1-5 below. For band n8 2Tx, the values proposed in proposal 1 and 2 are close. We can agree 0dB for 5MHz and 10MHz. For >10MHz, average approach would be fine. |

Sub topic 1-5 UE Architecture

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | Not sure if there are commercial 1Tx PC2 PA to support low FDD band. But currently, we think companies can bring MSD analysis based on both 1Tx and 2Tx. |

Sub topic 1-6 Requirements Evaluation

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | Fine with two proposals. |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic #1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic #2** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic #3** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic #4** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic #5** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic #6** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

## Discussion on 2nd round (if applicable)

# Topic #2: 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** |
| R4-2215894 | ZTE Corporation, China Unicom | **Observation:** No further modifications on sub-clause 6.2A.1.3 in TS38.101-1 specification, the single band maximum output power and Tx power tolerance can be applied.**Proposal 1:** Same ∆TIB, c and ∆RIB, c values of PC3 CA\_n1-n78 can be applied to DL CA\_n1-n78 with UL PC2 n1**Proposal 2:** No specific REFSENS requirements (i.e. MSD) defined for DL CA\_n1-n78 with UL PC2 n1. |
| R4-2215895 | ZTE Corporation, China Unicom | **Proposal 1:** Same ∆TIB, c and ∆RIB, c values of PC3 CA\_n3-n78 can be applied to DL CA\_n3-n78 with UL PC2 n3**Proposal 2:** No specific REFSENS requirements (i.e. harmonic mixing MSD) defined for DL CA\_n3-n78 with UL PC2 n3.**Proposal 3:** The harmonic MSD for DL CA\_n3-n78 with UL PC2 n3 are defined as: Table 7.3A.4-1a: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 aggressor NR UL band for NR DL CA FR1 |
| R4-2215660 | Apple | **Observation 1:** For CA\_n3-n78, compared to PC3 n3 UL, the MSD for n78 at 10MHz channel bandwidth caused by PC2 n3 1Tx UL is increased from 24.0 dB to 28.1 dB.**Observation 2:** For CA\_n3-n78, compared to PC3 n3 UL, the MSD for n78 at 10MHz channel bandwidth caused by PC2 n3 2Tx UL is increased from 24.0 dB to 35.4 dB.**Proposal 1:** RAN4 to take the MSD value in Table 2.1-3 into consideration for CA\_n3-n78 with PC2 n3 UL based on 1Tx.**Proposal 2:** RAN4 to take the MSD value in Table 2.2-2 into consideration for CA\_n3-n78 with PC2 n3 UL based on 2Tx. |

## Open issues summary

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

### Sub-topic 2-1 DL CA\_n1-n78 with UL PC2 n1

**Issue 2-1: 1Tx Architecture**

* Proposal 1: Same ∆TIB, c and ∆RIB, c values of PC3 CA\_n1-n78 can be applied to DL CA\_n1-n78 with UL PC2 n1.
* Proposal 2: No specific REFSENS requirements (i.e. MSD) defined for DL CA\_n1-n78 with UL PC2 n1.
* Recommended WF
	+ TBA

### Sub-topic 2-2 DL CA\_n3-n78 with UL PC2 n3

**Issue 2-2-1: 1Tx Architecture**

* Proposal 1: Same ∆TIB, c and ∆RIB, c values of PC3 CA\_n3-n78 can be applied to DL CA\_n3-n78 with UL PC2 n3.
* Proposal 2: No specific REFSENS requirements (i.e. harmonic mixing MSD) defined for DL CA\_n3-n78 with UL PC2 n3.
* Proposal 3: The harmonic MSD for DL CA\_n3-n78 with UL PC2 n3:
	+ Option 1:

Table 7.3A.4-1a: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 aggressor NR UL band for NR DL CA FR1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL BW** | **MSD** | **UL/DL fc condition** | **UL/DL harmonic order** |
| **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(dB)** |
| n3 | n78 | 5 | 15 | 25 (RBstart=0) | 10 | 26.2 | NOTE 2 | UL2/DL1direct-hit |
| n3 | n78 | 10 | 15 | 50 (RBstart=0) | 100 | 16.6 | NOTE 2 | UL2/DL1direct-hit |
| NOTE 2: The requirements should be verified for UL NR-ARFCN of the aggressor (high) band (superscript HB) such that in MHz and  with carrier frequency in the victim (lower) band in MHz and  the channel bandwidth configured in the higher band. |

* + Option 2:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| BW |  | Floor | H2 | Total |
| 10 MHz | Main Path (dBm) | -91.8 | -50.6 | -50.6 |
| Diversity Path (dBm) | -91.8 | -66.6 | -66.6 |
| After MRC (dBm) | -94.8 |  | -66.7 |
| MSD (dB) |  |  | **28.1** |

* Recommended WF
	+ TBA

**Issue 2-2-2: 2Tx Architecture**

* Proposal :The harmonic MSD for DL CA\_n3-n78 with UL PC2 n3:
	+ Option 1:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| BW |  | Floor | H2 | Total |
| 10 MHz | Main Path (dBm) | -91.8 | -56.4 | -56.4 |
| Diversity Path (dBm) | -91.8 | -56.4 | -56.4 |
| After MRC (dBm) | -94.8 |  | -59.4 |
| MSD (dB) |  |  | **35.4** |

* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

Sub topic 2-1 DL CA\_n1-n78 with UL PC2 n1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | Fine with the proposals |

Sub topic 2-2 DL CA\_n3-n78 with UL PC2 n3

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | (modify the title a bit)Fine with the proposal 1 and proposal 2.For proposal 3, the two values difference are not very large. So adopting average values in this meeting?For proposal 4, the MSD looks a bit too high, maybe more inputs from other companies would be needed. |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic#2** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
|  | WF on … | YYY |  |
|  | LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents