**3GPP TSG-RAN WG4 Meeting # 104-bis-e R4-2217769**

**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** |
| Huawei | Jin Wang | [jinwang@huawei.com](mailto:jinwang@huawei.com) |
| ZTE | Wubin Zhou | Zhou.wubin@zte.com.cn |
| Skyworks Solutions Inc. | Dominique Brunel | Domnique.brunel@skyworksinc.com |
| Apple | James Wang | fucheng\_wang@apple.com |
| Qualcomm Incorporated | Gene Fong | gfong@qti.qualcomm.com |
| SoftBank | Masashi Fushiki | masashi.fushiki@g.softbank.co.jp |
| vivo | Ziqi Liu | liuziqi@vivo.com |
| T-Mobile USA | Bill Shvodian | bill.shvodian@t-mobile.com |
| NTT DOCOMO | Yuta Oguma | yuuta.oguma.yt@nttdocomo.com |
| Meta | Suhwan Lim | suhlim@meta.com |

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.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NR  band | 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 | 5  MHz (dB) | 10  MHz (dB) | 15  MHz (dB) | 20  MHz (dB) | 25  MHz (dB) | 30 MHz (dB) | 35 MHz (dB) | 40  MHz (dB) | 45 MHz (dB) | 50  MHz (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. |
| T-Mobile USA | 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. |
| Huawei (JW) | Fine with the proposal. Regarding band n28, the PC3 tolerance is +2/-2.5dB, which has extra 0.5 dB for the lower bound. Does ZTE suggest to apply +2/-3.5 for n28 PC2? |
| ZTE | To huawei  No, my comments is not for the MOP tolerance itself (+2/-3 is fine to us), but for MOP tolerance at the band edge, i.e. Note 3. |
| Apple | We are okay with the proposal. The band edge tolerance in general would follow PC3. However, if duplexer would be redesigned to accommodate higher power rating, whether the exiting tolerance can be reused may need further studies. |
| vivo | We support the proposal. |
| T-Mobile USA | We support the proposal |

Sub topic 1-3 A-MPR

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei (JW) | Regarding P1-P7, we’re fine to evaluate the PC2 A-MPR for those network signals. However, we cannot accept the proposed A-MPR values at this stage. Further simulations/measurements are needed. |
| Skyworks | In our contribution we also stated that further evaluation and measurements are needed. We just provided tentative A-MPR for some allocations and the essential is to point at the NS to be evaluated and the allocation type behavior |
| Apple | We are okay with this proposal package as the guideline for A-MPR evaluations. The final requirements shall be based on the collected evaluation results among companies. |
| Qualcomm | We are ok with the proposals as a starting point with the understanding that companies will do the detailed analysis, measurements, and simulations. Although the starting point can be for example to keep the same inner/outer regions as PC3, the final outcome will depend on the technical studies. |
| SoftBank | Thank you very much for the proposals. We are supportive of the activities for analyzing the A-MPR. |
| T-Mobile USA | We support the proposals |
| NTT DOCOMO | We support the introduction of the NS related requirements, especially for NS\_100 and NS\_17 from our perspective. |

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. |
| Huawei (JW) | Thanks Apple and ZTE for the contribution. We need more time to check the REFSENS values. Hence, we propose to record those proposals in the TR as we did in TR38.861, and seek agreements in the coming meetings. |
| Skyworks | We will do our evaluation and thank Apple and ZTE for their values as a starting point. We will focus on 1Tx cases. |
| Apple | Our MSD values for n8 at 20MHz and 35MHz are slightly worse than ZTE’s numbers as we assumed 1dB more Tx noise contribution as compared to PC3 due to RIMD between the two PAs. We can wait for more analysis results from other companies before consolidating the MSD values.  Our 1Tx MSD analysis will rely on Tx simulations. Hope we will be able to share our results in next RAN4 meeting. |
| T-Mobile USA | We are fine with Proposal 1. |

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. |
| Huawei (JW) | Share similar view with ZTE. Both 1Tx and 2Tx should be supported. |
| Skyworks | We will provide input for 1Tx in LB and 1/2Tx in MB. |
| Apple | We are okay with the proposal to focus on 1Tx only for sub-1GHz bands. |
| Qualcomm | Given that the example bands from which this basket originated specified both 1Tx and 2Tx, we aren’t quite ready to abandon 2Tx from low band just yet, but prefer to wait for the data. |
| China Unicom | From our view, both 1Tx and 2Tx requirements can be considered at current stage. |
| CHTTL | support to consider both at this stage |
| vivo | In our view, 1Tx for LB is a more practical implementation. |
| T-Mobile USA | We support the proposal. |

Sub topic 1-6 Requirements Evaluation

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | Fine with two proposals. |
| Huawei (JW) | Since there’re many bands to be defined in the WI, we think P1 and P2 are the suitable way forward. Apart from the use of the TR, we may also adopt a running bigCR approach to collect draft CRs for individual bands along the way. |
| Skyworks | Proposals 1 and 2 make sense |
| Apple | We agree with re-using established RF assumptions and the agreed antenna isolation assumption for 2Tx evaluation. |
| China Unicom | We are fine with the proposals. |
| T-Mobile USA | We are fine with the 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 TR Skeleton** | *Tentative agreements: Agree on the TR skeleton.*  *Candidate options:*  *Recommendations for 2nd round: None* |
| **Sub-topic #2 Tx power & Tolerance** | *Tentative agreements:*  *There were no comments received except for band n28 in 1st round, so Tx power and tolerance of PC2 for the remaining FDD bands can be agreed, i.e.:*   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | NR  band | 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 | | n66 |  |  |  |  | 26 | +2/-3 | | n71 |  |  |  |  | 26 | +2/-3 | | n85 |  |  |  |  | 26 | +2/-33 |   *Candidate options:*  *Recommendations for 2nd round: Further check whether the Note 3 applies to n28 PC2.* |
| **Sub-topic #3 A-MPR** | *Tentative agreements: Taking the proposals on A-MPR in this meeting as reference/starting point, companies may bring more detailed analysis, measurements, and simulations in the upcoming meetings.*  *Candidate options:*  *Recommendations for 2nd round: None* |
| **Sub-topic #4 REFSENS** | *Tentative agreements: Results submitted in this meeting can be taken as reference/starting point, and wait for more inputs by companies from upcoming meetings.*  *Candidate options:*  *Recommendations for 2nd round: None* |
| **Sub-topic #5 UE Architecture** | *Tentative agreements: Analyses on both 1Tx and 2Tx requirements are considered at current stage. Requirements will be discussed based on companies’ contributions.*  *Candidate options:*  *Recommendations for 2nd round: None* |
| **Sub-topic #6 Requirements Evaluation** | *Tentative agreements:*  *Reuse the Rel-17 methodology and RF assumptions in R4-2119946 (WF on NR FDD PC2 HPUE, RAN4#101-e) to evaluate A-MPR and MSD requirements for the requested FDD bands.*  *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*  *Candidate options:*  *Recommendations for 2nd round: None* |

## Discussion on 2nd round (if applicable)

Comments on draft WF shared in “TSGR4\_104bis-e / Inbox / Drafts / [104-bis-e][116] HPUE\_Basket\_FDD / Rnd2” folder

|  |  |
| --- | --- |
| **Company** | **Comments** |
| T-Mobile USA | We are fine with the Way Forward |
| Skyworks | ok |
| Meta | Support the draft WF. |
| Apple | We are okay with the WF. |
| ZTE | Support the draft WF. |
| vivo | We are fine with the WF. |
| NTT DOCOMO | We are fine with the WF. |

# 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/DL1  direct-hit |
| n3 | n78 | 10 | 15 | 50 (RBstart=0) | 100 | 16.6 | NOTE 2 | UL2/DL1  direct-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 |
| Apple | We are okay with the proposals. |
| China Unicom | Fine with proposals. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | (modify the title a bit)  Issue 2-2-1:  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?  Issue 2-2-2:  The MSD looks a bit too high, maybe more inputs from other companies would be needed. |
| Huawei (JW) | Issue 2-2-1:  Fine with P1 and P2. Regarding P3, an average between option 1 and 2 would be fine.  Issue 2-2-2:  Need more time to check. Prefer to delay the decision to the next meeting. |
| Apple | We are okay with Proposal 1. For proposal 2, we think it is meant to say the n3 harmonic mixing MSD requirement is not affected by n3 PC2 UL. For UL harmonic MSD to n78, we can wait for more analysis results from companies before consolidating the requirements. |
| China Unicom | Issue 2-2-1:  Fine with proposals and the averaging approach.  Issue 2-2-2:  Prefer to wait for more inputs from companies. |

## 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 DL CA\_n1-n78 with ULHP on n1** | *Tentative agreements:*  Same ∆TIB, c and ∆RIB, c values of PC3 CA\_n1-n78 can be applied to DL CA\_n1-n78 with UL PC2 n1. No specific REFSENS requirements (i.e. MSD) defined for DL CA\_n1-n78 with UL PC2 n1.  *Candidate options:*  *Recommendations for 2nd round: None* |
| **Sub-topic#2 DLCA\_n3-n78 with UL HP on n3** | *Tentative agreements:*  Issue 2-2-1: 1Tx Architecture:  Same ∆TIB, c and ∆RIB, c values of PC3 CA\_n3-n78 can be applied to DL CA\_n3-n78 with UL PC2 n3. No specific REFSENS requirements (i.e. harmonic mixing MSD) defined for DL CA\_n3-n78 with UL PC2 n3.  Agree on the average values for “Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 aggressor NR UL band” from this meeting (i.e. 27.1dB for 10MHz DL BW, 16.6dB for 100MHz DL BW).  Issue 2-2-2: 2Tx Architecture:  Wait for more inputs from companies in upcoming meetings.  *Candidate options:*  *Recommendations for 2nd round: None* |

## 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”.*

Comments on draft WF shared in “TSGR4\_104bis-e / Inbox / Drafts / [104-bis-e][116] HPUE\_Basket\_FDD / Rnd2” folder

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Skyworks | For the n3-n78 case can we simplify by have only the worst case MSD? |
| Meta | Fine with the draft WF. For the CA\_n3-n78, RAN4 follow the agreed RAN4 WF(R4-2210565) for harmonic issues as follow  **P5: Guidelines for the UL band configuration.**  For all MSD test points:   * Lcrb and RBstart specify the UL RB allocation which ensures that the DL affected band RX CBW entirely overlaps the harmonic interference power spectral density (PSD) [3], * The UL band is configured with the lowest UL CBW and the lowest SCS that can accommodate the specified UL Lcrb. For example, if the Lcrb is 25RB, the UL configuration should be 5MHz CBW, SCS15kHz. * **The “lowest” and the “highest” CBW shall not exceed the CBW specified in the BCS configuration tables of clause 5.5A.**   **P7: There is no need to specify the UL band and the DL band carrier-centre frequencies.**  These guidelines ensure the UL/DL configuration are a subset of the legacy MSD test points, there is no need to re-evaluate MSD levels. Proposals 4,5,6,7 are illustrated in Table 1 and Table 2 and proposed in round 1 proposed draftCR [5].  Table 1 New MSD table format for MSD due to Tx harmonic (Table 7.3A.4-1) |
| Apple | We support to only specify the worst-case (lowest victim band channel BW) and no longer to specify the near miss configuration, same for compliance tests. |
| CHTTL | In general fine with the WF, for the n3-n78, we prefer to align with the way of defining PC3 requirement and keep the “highest” CBW on DL victim band as well. |
| ZTE | In general fine with the WF.  For n3-n78, there are three MSD test points defined for PC3 n3-n78, we also think there is no need to specify the near-miss configuration.    So the other two MSD test points for PC2 n3-n78 are the same with PC3.  If only the worst case MSD is defined for PC2, then it is inconsistency between PC2 and PC3. We think it should be done for PC3 and PC2 as a package. But for now, we think it should better to keep the PC2 and PC3 align except for the near-miss. |
| vivo | We support to only specify the worst-case MSD. |
| Huawei | We have some concerns on the proposal of only specifying the worst-case MSD and prefer to further discuss it in the next meeting.  In the example of n3+n78 or n1+n77, the MSD is 1.1 dB for the near-miss for PC3, while it could be 4.1dB or more for PC2. No specifying this means no exception is allowed, which is effectively tightening the UE requirements.  If the intention is to reduce the test burden, maybe the alternative is to test only the worst case, while other cases can be optionally tested if requested. |

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
|  | *WF on requirements for HPUE\_Basket\_FDD* | *China Unicom* | *Capture the agreements and guidelines made in this meeting, so that they can later be reflected for requirements analyses and TP/CR preparations.* |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-2215852 |  | TR 38.xxx v0.0.1 HPUE\_NR\_FR1\_FDD\_R18 | China Unicom | Agreeable |  |
| R4-2215331 |  | Architecture MSD and A-MPR aspects for PC2 FDD low bands | Skyworks Solutions Inc. | Noted |  |
| R4-2215332 |  | Architecture MSD and A-MPR aspects for PC2 FDD mid bands | Skyworks Solutions Inc. | Noted |  |
| R4-2215661 |  | MSD analyses for PC2 FDD bands with 2Tx | Apple | Noted |  |
| R4-2215893 |  | Discussion on PC2 band n8 RSD | ZTE, China Unicom | Noted |  |
| R4-2216124 |  | Discussion on the PC2 UE maximum output power and Tx power tolerance | vivo | Noted |  |
| R4- 2216774 |  | Initial consideration on PC2 FDD bands | Huawei, HiSilicon | Noted |  |
| R4-2215894 |  | On CA band combination of DL CA\_n1-n78 with UL PC2 n1 | ZTE, China Unicom | Noted |  |
| R4-2215895 |  | On CA band combination of DL CA\_n3-n78 with UL PC2 n3 | ZTE, China Unicom | Noted |  |
| R4-2215660 |  | MSD analysis for CA\_n3-n78 with PC2 n3 UL | Apple | Noted |  |

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 |  |
| R4-2217121 |  | WF on requirements for HPUE\_Basket\_FDD | *China Unicom* | Agreeable |  |

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