**3GPP TSG-RAN WG4 Meeting # 112 R4-2412837**

**Maastricht, Netherlands, August 19th – 23rd, 2024**

**Agenda item:** 10.1

**Source:** Moderator (Qualcomm Incorporated)

**Title:** Topic summary for [112][135] UERF\_Spec\_Improvement

**Document for:** Information

# Introduction

This document is the moderator summary for UE RF Specification improvements covering papers submitted to agendas:

10.1.1 UE RF specifications TS 38.101-1/-2/-3

10.1.1.1 Technical wording ambiguities and Table modifications

10.1.1.2 Work practice enhancements

10.1.1.3 Larger specification structure enhancements

For reference, previous agreements are in

R4-2410714 WF on UERF\_Spec\_Improvement Qualcomm, 3GPP TSG-RAN WG4 Meeting #111, Fukuoka City, Fukuoka , Japan, 20th – 24th May, 2024

R4-2406709, “WF on UERF\_Spec\_Improvement” Qualcomm, 3GPP TSG-RAN WG4 Meeting #110Bis, Changsha, China, 15th – 19th April, 2024

# Topic #1: Technical wording ambiguities and Table modifications

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

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [**R4-2411111**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411111.zip) | On technical wording ambiguities and table modifications for UE RF specs improvement | CATT | **Proposal 1: For configuration EN-DC tables, do not consider order of increasing carrier frequency for LTE and NR carriers and remove redundant symmetric table cells for each BCS as illustrated in Table - 1.**Table – 1: Simplification of configuration tables of EN-DCSee reference**Observation 1: Option 1 for simplifying ΔTIB,c and ΔRIB,c tables reduces readability since the lexicographic order of the band combinations is lost.****Observation 2: Option 2 for simplifying ΔTIB,c and ΔRIB,c tables involves altering core requirements which is not feasible at this late stage.****Proposal 2: RAN4 to introduce the template-based approach for simplifying ΔTIB,c and ΔRIB,c tables as Opton 3, which keeps both lexicographic order of band combinations and readability.** |
| [**R4-2411237**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411237.zip) | Technical wording ambiguities and Table modifications handling | Huawei, HiSilicon | Observation 1: RAN4 requirements are minimum requirements to accommodate various UE implementation options and the requirements should be reasonable for the industry including aspects such that power consumption, cost etc. Observation 2: Option 2 tightens the existing requirements which may preclude some implementation choices.Observation 3: Option 2 has no technical justification to tighten the existing requirements as well as does not guarantee future challenges that RAN4 may face, e.g., larger number of bands in a certain frequency range may require more relaxations.Observation 4: Adopting Option 2 means no tables for relaxation values and it leads to a situation that specifications lose some essential information like simultaneous Rx/Tx and accompanied values specifically for BCs with two bands.Observation 5: Having reasonable values in specifications is also one of the key factors for the quality of the specifications and the values in the current specifications are the ones that we have been able to find out as the most reasonable values.Proposal 1: RAN4 shall not adopt Option 2 or similar approaches and not tighten the existing requirements for the sake of specification quality improvement.Proposal 2: Adopt the following approach.* + - 1. Apply followings to band combinations (BCs) with two bands,
				1. Maintain the values for ΔTIB,c and ΔRIB,c for BCs in the tables for BCs with two bands.
				2. Put 0 dB being handled as zero (i.e., not listed in the tables for two bands) with respective BCs in the tables for BCs with two bands.
			2. Apply followings to BCs with more than two bands, values for ΔTIB,c and ΔRIB,c for BCs with more than two bands are derived by taking maximum among all the values for the corresponding respective bands from all the fallback BCs only with two bands.
				1. For example, regarding CA\_n1-n3-n78, ΔTIB,c for CA\_n1-n3, CA\_n1-n78 and CA\_n3-n78 are (0.3 dB, 0.3 dB), (0.3 dB, 0.8 dB) and (0.6 dB, 0.8 dB), respectively.
				2. Take max for each band like max (0.3 dB, 0.3 dB) for n1, max (0.3 dB, 0.6 dB) for n3 and max (0.8 dB, 0.8 dB) for n78. Then, the values for the respective bands for CA\_n1-n3-n78 become (0.3 dB, 0.6 dB, 0.8 dB) = (n1, n3, n78).
				3. It’s noted that the values currently specified are (0.6 dB, 0.6 dB, 0.8 dB) = (n1, n3, n78). Thus, this does not always give the same values in the current specifications.
				4. Thus, some exceptions are needed for specifically BCs whose degree of implementation challenges drastically changes compared to fallback BCs with two bands
			3. If a BC with more than two bands has more than two bands at least in any one of the frequency ranges, below 1 GHz, 1.4 - 2.7 GHz and above 2.7GHz, RAN4 shall discuss values on case-by-case basis instead of applying the 2nd main bullet in the proposal 2 to it and list the values in the corresponding tables as exception
				1. For a BC with more than three bands, values for ΔTIB,c and ΔRIB,c for bands group(s) consisting of more than two bands which falls into one of the frequency ranges, the values are derived based on the 3rd main bullet (i.e., case by case analysis is needed) in the proposal 2, while values for ΔTIB,c and ΔRIB,c for the remaining band(s) are derived based on the 2st main bullet in the proposal 2 .
				2. E.g., A+B+C+D+E where A+B+C falls into one of the frequency ranges, then, values derived based on the 3rd main bullet in the proposal 2 applies, while the 2nd main bullet applies to D and E to derive values.
				3. For another example, if a completely new band combination with four bands whose three of the four bands are below 1GHz, then, the proponent of this band combination shall provide technical analysis on values in their TP.
			4. Those above shall be allowed to be revisited whenever necessary.
				1. This is because there may be aspects that we have not been aware of at the writing of this contribution

<Wording ambiguities>Observation 6: The discussion on CA requirement applicability requires technical discussion.Proposal 3: CA requirement applicability should be handled in HPUE CA power class agenda item.Observation 7: From following current situations, if we use one of dual Tx and 2Tx, using 2Tx is rational.* If we selected dual Tx, i.e., replaced 2Tx with dual Tx, could we change e.g., 2Tx-2Tx into dual Tx - dual Tx for uplinkTxSwitching? If we select 2Tx, 2Tx for uplinkTxSwitching can stay as they do.
* For 4Tx, we haven’t used quad Tx thus far. If we used dual Tx instead of 2Tx, we would need to use quad Tx instead of 4Tx for consistency.

Proposal 4: Replace “dual Tx” with “2Tx”.<modifiedMPR-Beehaviour>Observation 8: “If the bit is not set” has no ambiguity if a band has multiple definitions in *modifiedMPR-Behaviour*Observation 9: “If the bit is not set” is still understandable even if a band has single definition in *modifiedMPR-Behaviour if readers are aware of Observation 8.*Proposal 5: If RAN4 pursues more clarification, modify the text in a way of “if the bit is not set or a parameter of *modifiedMPR-Behaviour* in BandNR is not present,”<Handling of NOTEs in a table>Observation 10: handling NOTEs in a table is not consistent across a specification or over the RAN4 specificationsObservation 11: Granularity of NOTEs applicability in a table may be even finer than originally MCC expected in TR21.801.Proposal 6: RAN4 should discuss necessity of more practical drafting rule for NOTEs handling in a table for the future specifications. |
| [**R4-2411313**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411313.zip) | Views on technical wording ambiguities | Samsung,CHTTL | **(For “Assigned to”)*****Observation 1: “Assigned to” has different meanings for different requirements.******Observation 2: Change closed release may have adverse impact on commercial implementation.******Observation 3: Change from open release may cause NBC issue.******Observation 4: Based on the experience of the “famous” over one year debate of NR\_Power\_Class, we feel pessimistic there would be any meaningful outcome.******Proposal 1: Stop the discussion for clarification of “assigned to” and do not make change to spec.*****(For “Dual Tx/2Tx/TxD/4Tx”)*****Proposal 2: Confirm the following understanding:******In current RAN4 spec,*** ***- “Dual Tx” is not intended for “dualPA-Architecture”******- “Dual Tx” intends for “2Tx-TxD” if the relevant description is not from UL-MIMO clauses******- “Dual Tx” intends for “2 Tx antenna connectors” if the relevant description is from UL-MIMO clauses******- “2Tx” intends for “2Tx antenna connectors”, “4Tx” intends for “4Tx antenna connectors”******- “TxD” can be “2Tx-TxD” and/or “4Tx-TxD”, it is easy to judge which it is based on the context.******Proposal 3: Add clarification in Clause 6.1, the following can be the starting point.*** Unless otherwise stated, in the following sub clauses, * The term “Dual Tx” refers to two Tx antenna connectors if the associated description is in suffix D.
* The term “Dual Tx” refers to 2Tx Tx diversity capability if the associated description is in the suffix other than suffix D.
* The term “Dual Tx” is not intended for *dualPA-Architecture.*
* The terms“Dual Tx” and “2 Tx” all refer to two Tx antenna connectors, and “4Tx” refer to four Tx antenna connectors.

**(What does “if the bit is not set” mean?)*****Proposal 4: RAN4 to discuss what is the correct interpretation for “If the bit is not set” in Table L.1-1 of 38.101-1.*** * **Interpretation 1:** *modifiedMPR-Behavior* shall be present and this bit is set to 0 → From the perspective of English grammar
* **Interpretation 2:** *modifiedMPR-Behavior* is absent → Given it is not necessary for UE to specifically indicate this IE if only leftmost bit is utilized which is a waste of signaling
* **Interpretation 3:** Including both Interpretation 1 and 2. → Most reasonable interpretation given for example a legacy Rel-16 UE supporting n39 may could not indicate this IE

***Proposal 5: If the above interpretation 3 is agreed for “if the bit is not set”. Change “If the bit is not set” to “If modifiedMPR-Behavior is absent, or modifiedMPR-Behavior is present with this bit set to 0” of Table L.1-1 of 38.101-1.***  |
| [**R4-2411676**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411676.zip) | Spec improvements: technical wording ambiguities | Ericsson | **Observation 1: for intra-band CA requirements in Clause 6 of 38.101-1, requirements “for CA” apply for configured UL serving cells regardless of their activation status.** **Observation 2: the wording “carrier(s) assigned to an NR band” is mainly used for inter-band CA and DC, the inter-band requirements in clause 7 apply for active carriers and would not change in the presence of other configured, but deactivated, cells of a band combination.**and propose**Proposal 1: do not change the wording “for CA” and “carriers assigned to an NR band” for defining applicability of CA requirements for consistency with earlier versions of the specifications.** **Proposal 2: in case requirements are changed for CA configurations with deactivated carriers, this should be explicitly specified in the relevant version of the specification but is not part of the RAN task on specification quality improvement.** **Proposal 3: state in the general clause 6.1 that the notions “dual TX” and “2Tx” etc all refer to two Tx antenna connectors.** |
| [**R4-2411838**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411838.zip) | Considerations on specification improvement for table modification | ZTE Corporation, Sanechips | **Observation 1. It is observed that due to the large number of CA BW classes in FR2, the inter-band CA configuration table has been greatly optimized by using the grouping rules with delimiter “/” in uplink CA. The retrieval of a certain band combination in the configuration table has no impact since the downlink CA remains no change.****Proposal 1. For inter-band DC configurations with FR2 part of the uplink configurations, it is proposed to optimize the configuration tables with the following grouping rules.*** **For inter-band DC configurations, the delimiter “/” could be used for the FR2 part of the uplink configurations, such as DC\_xA\_nyA/B/C, where x and ny are E-UTRA band and FR2 NR band, and A, B and C are the corresponding bandwidth classes respectively.**
* **For inter-band NR-DC configurations between FR1 and FR2, the delimiter “/” could be used for the FR2 part of the uplink configurations, such as DC\_nxA\_nyA/B/C, where nx and ny are FR1 NR band and FR2 NR band, and A, B and C are the corresponding bandwidth classes respectively.**

**Observation 2. With Proposal 1, it is obvious that optimization to inter-band DC configuration table has the following benefits.*** **More concise and readable uplink configurations.**
* **Same grouping rules as inter-band CA configurations for uplink.**
* **Reduced configuration table size.**
* **No information lost in the optimization.**

**Observation 3. The candidate DC table optimization in [3] has big change to the current configuration table and will have big impact on combo retrieval.****Proposal 2. It is proposed to use the solution as in proposed in Proposal 1 to optimize the inter-band DC configurations.*** **The optimization could be applied starting from Rel-19 and the draft CRs be ready before Dec, 2024.**
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| R4-2413065 | Cross-band isolation MSD simplification | Skyworks Solutions Inc. | N/A |
| [**R4-2413066**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413066.zip) | Further MSD simplifications | Skyworks Solutions Inc. | **Observation**: With regards to WF [1]:* Option 1: It is premature at this stage to support fully this option until the impact on the ecosystem is fully understood.
* Option 2: Only a few contributions have been presented so far at RAN4 towards reducing our workload and the TS complexity. More studies are needed to converge towards a consensus. Some MSD are more difficult to simplify than others, e.g. MSD due to dual-UL IMD.
* We believe Option 3 should be ruled out.

**Proposal**: As an initial proposal towards Option 2, we propose that Rel-19 HPUE MSD requirements for inter-band CA with an FDD HPUE band are reduced to a single set of requirements; and, this single set captures the worst-case MSD requirements. This means that RAN4 no longer has to study two sets of MSD: one set of UE supporting single Tx and another set for UEs supporting dual Tx. |
| [**R4-2413068**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413068.zip) | Update on Harmonic MSD simplification | Skyworks Solutions Inc. | In this contribution, we bring additional harmonic measurement data that confirms that the PC2 harmonic interference may be assumed 3dB greater than the PC3 level and we provided updated and simplified PC2 MSD lookup tables for single Tx and dual TX MSD requirements.**Observation 1**: Under RAN4 PA linearity calibration test conditions, we may assume that the harmonic interference level for PC2 operation is approximately 3dB higher than for PC3 operation.**Proposal 1:** Consider adopting the PC2 single Tx MSD look-up of Table 1 where the PC2 MSD is expressed asPC2 single Tx MSD = PC3 MSD + ΔPC2\_1Tx.**Table 1:** PC2 single-Tx simplified MSD using PC3 lookup tables

|  |  |
| --- | --- |
| **Agreed PC3 MSD** | **Proposed** **ΔPC2\_1Tx**  |
| PC3 MSD ≥ 10dB | 3.0dB |
| 5.0dB ≤ PC3 MSD < 10dB | 2.5dB |
| 3.0dB ≤ PC3 MSD < 5.0dB | 2.0dB |
| 1.8dB ≤ PC3 MSD < 3.0dB | 1.5dB |
| 1.0dB ≤ PC3 MSD < 1.8dB | 1.0dB |
| PC3 MSD < 1.0dB or no PC3 MSD | Analysis case by case |
| NOTE 1: This set of PC2 single-Tx MSD class assumes an equal level of interference between the primary antenna and the diversity antenna. |

**Proposal 2:** Consider adopting the PC2 dualTx MSD look-up of Table 2 where the PC2 MSD is expressed asPC2 dual Tx MSD = PC3 MSD + ΔPC2\_2Tx.**Table 2:** PC2 dual-Tx simplified MSD using PC3 lookup tables

|  |  |
| --- | --- |
| **Agreed PC3 MSD** | **PC2 2Tx****MSD3** |
| **[dB]** |  |
| PC3 MSD ≥ 15dB | 8.0 |
| 8.5dB ≤ PC3 MSD < 15dB | 7.0 |
| 6.5dB ≤ PC3 MSD < 8.5dB | 6.0 |
| 4.5dB ≤ PC3 MSD < 6.5dB | 5.0 |
| 3.5dB ≤ PC3 MSD < 4.5dB | 4.0 |
| 2.5dB ≤ PC3 MSD < 3.5dB | 3.0 |
| 1.0dB ≤ PC3 MSD < 3.5dB | 2.0 |
| PC3 MSD < 1.0dB or no PC3 MSD | [FFS] |
| NOTE 3: This set of PC2 dual-Tx MSD assumes an 9dB lower interference on diversity than on primary antenna port.  |

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| [**R4-2413338**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413338.zip) | On UE RF specifications table improvement | Nokia | Observation 1: Currently it is not possible to condense all the information and requirements for a single DL configuration into a single table.Observation 2: The long-term goal is to move the listing of band combinations to a database managed by MCC.Observation 3: Multiple tables are now listing band combinations meaning that there are numerous long tables in the specification.Observation 4: Currently the RAN4 UE RF specification has separate tables for each UE relaxation type, e.g. MSD due to harmonica mixing issues.Observation 5: Providing a list of supported band combinations together with their “issues” requiring relaxation would provide an overview instead of spreading the information over multiple tables in the specification.Observation 6: Annex A show the statistics and investigations conducted for the currently defined UE relaxations in TS 38.101-1 clause 7.Observation 7: RAN4 could reduce the length of TS 38.101-1 by 21 pages using the approach presented here.Proposal 1: RAN4 shall further develop the unified table approach for UL configurations as presented in this Toc and adopt this in the specification.Proposal 2: RAN4 shall further investigate whether a unified tabled can be developed for DL configurations.Observation 8: Currently there are multiple mistakes in the ordering of the listed band combinations in the specification.Observation 9: The organization of Rel-19 band combination baskets can mitigate some of the issues with the listing/ordering of band combinations in the specification. |
| [**R4-2411146**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411146.zip) | Simplifying ?RIB,c and ?TIB,c tables | Apple | ***Proposal 1****:* *RAN4 to agree to remove the* ΔRIB,c and ΔTIB,c *tables in 38.101-1 and 38.101-3 and replace them by generic values based on the number of bands in the DL configuration as exemplarily shown below:*Table 7.3A.3.2-1: ΔRIB,c due to NR CA

|  |  |
| --- | --- |
| Number of bands in DL configuration | ΔTIB,c[dB] |
| 2 | 0.0 |
| 3 | 0.2 |
| 4 | 0.3 |
| 5 | 0.4 |
| 6 | 0.5 |

Table 6.2A.4.2-1: ΔTIB,c due to NR CA

|  |  |
| --- | --- |
| Number of bands in DL configuration | ΔTIB,c[dB] |
| 2 | 0.1 |
| 3 | 0.2 |
| 4 | 0.3 |
| 5 | 0.4 |
| 6 | 0.5 |

***Proposal 2****: RAN4 to agree to replace the* ΔRIB,c and ΔTIB,c *tables in 38.101-1 and 38.101-3 in Rel. 18 as maintenance CRs.****Proposal 3****: If Proposal 2 cannot be agreed, RAN4 to agree to replace the* ΔRIB,c and ΔTIB,c *tables in 38.101-1 and 38.101-3 in Rel. 19.* |
| [**R4-2411147**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411147.zip) | Simplifying or removing MSD tables | Apple | In this contribution we summarize the issues of the current MSD specifications. It is shown that the currently specified MSD values are not useful at all, they are defined in a way that the values cannot be used for any purpose. We propose ways to simplify the specs by removing the MSD tables.***Observation 1****: MSD tables are used to define exceptions from the normal CA/DC Refsens test in case of harmonic/IMD/cross-band isolation issues.****Observation 2****: MSD tables describe the worst case scenario, which is usually not used in the network due to the worst case network performance. The MSD information in the spec is not helpful in this case****Observation 3****: The network cannot use the MSD values from the spec, as there is no information available for the exact use case in the network (frequencies, bandwidths,* RB allocations, *output power, RX performance etc.)****Observation 4****: As specified in 38.101-1, in the RAN5 specs (38.521-1) the NR-CA Refsens value is measured for the cases without exceptions. The cases with Refsens exceptions using the worst case values from the MSD tables is tested separately.****Observation 5****: Although specified in 38.101-3, in the RAN5 specs (38.521-3) the EN-DC Refsens value without exceptions is not measured. Instead the test spec is pointing to the E-UTRA and NR specs. RAN5 only tests the Refsens exceptions with the worst case values from the MSD tables. There cannot be a fail when the MSD spec is missing, as there is no EN-DC test.****Observation 6****: Sensitivity degradation in many cases happens due to TX power leaking between the TX antenna(s) and the RX antenna(s) due to limited antenna isolation, but MSD is only specified and tested in conducted mode, not taking into account the radiated effects.****Observation 7****: Refsens is usually a measurement to determine the noise figure of the receiver, but the NF is already measured in single carrier mode. Therefore Refsens for NR-CA could be skipped, similarly as Refsens for EN-DC is already skipped.****Observation 8****: The MSD tables do not contain the use cases needed in the network and are so huge and complex that the information from the MSD tables cannot be used by the network to optimize the network scheduling to avoid MSD issues.****Observation 9****: If the connection fails due to harmonic or IMD issues, the BS will become aware of the failure by ACK/NACK or the measurement reports, this may take a while.****Observation 10****: Once the BS detects the failure, the BS needs to react and try another CA combination, RB allocation or lower TX power to reduce the IMD/harmonic issues.****Proposal 1****:* *Remove the Refsens specifications in* 38.101-1 clauses 7.3A.2.3, 7.3A.4, 7.3A.5, 7.3A.6, 7.3A.7 and 38.101-3 clauses 7.3B.1 and 7.3B.2.3 *including the MSD tables for CA/DC combinations replacing them with a reference to the single band Refsens measurements****Proposal 2****: If Proposal 1 is not agreeable, we can keep the general Refsens specification but with a normative note that the Refsens values are only applicable in case there is no IMD or harmonic or cross-band isolation issue. The MSD tables can be removed.****Proposal 3****: If both, Proposal 1 and Proposal 2, are not agreeable, we can simplify the exception tables by removing the MSD tables and replacing them with tables just listing the combinations having an exception, but without specifying not needed MSD values nor specifying MSD test conditions.****Proposal 4****: If Proposal 1, 2 and 3, are not agreeable, we can simplify the MSD tables by removing most of the MSD combinations keeping only some exemplary combinations and add a separate table listing all the combinations having an exception, but without specifying MSD values or MSD test conditions.* |
|  |  |  |  |

## 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 1-1 Terminology

*Sub-topic description: dual TX vs 2Tx*

*Open issues and candidate options before meeting:*

**Issue 1-1:** dual Tx vs 2Tx meaning and usage is overlapping and not clear what is the difference

Proposals

* + Option 1: Proposal 4 in R4-2411237(HW) Replace “dual Tx” with “2Tx”.
	+ Option 2: Proposal 2 in R4-2411313 (Samsung) ***In current RAN4 spec,***

***- “Dual Tx” is not intended for “dualPA-Architecture”***

***- “Dual Tx” intends for “2Tx-TxD” if the relevant description is not from UL-MIMO clauses***

***- “Dual Tx” intends for “2 Tx antenna connectors” if the relevant description is from UL-MIMO clauses***

***- “2Tx” intends for “2Tx antenna connectors”, “4Tx” intends for “4Tx antenna connectors”***

***- “TxD” can be “2Tx-TxD” and/or “4Tx-TxD”, it is easy to judge which it is based on the context.***

* ***Option 3:* Proposal 3 in R4-2411676 (Ericsson): state in the general clause 6.1 that the notions “dual TX” and “2Tx” etc all refer to two Tx antenna connectors.**
* Recommended WF
	+ Option 1

Agreement:

* Replace “dual Tx” with “2Tx”
	+ Changes should be from Rel-15

### Sub-topic 1-2 Modifed MPR

*Sub-topic description*

*Open issues and candidate options before meeting:*

**Issue 1-2: Modified MPR**

* Proposals
	+ Option 1: Proposal 5 in R4-2411237 (HW) : If RAN4 pursues more clarification, modify the text in a way of “if the bit is not set or a parameter of *modifiedMPR-Behaviour* in BandNR is not present,”
	+ Option 2: Proposal 5 in R4-2411313(Samsung): Change “If the bit is not set” to “If modifiedMPR-Behavior is absent, or modifiedMPR-Behavior is present with this bit set to 0” of Table L.1-1 of 38.101-1.
* Recommended WF
	+ Both options seem feasible and non-intrusive changes that do not change the requirement

Agreement: no change of the current specification.

### Sub-topic 1-3 Notes use

*Sub-topic description*

*Open issues and candidate options before meeting:*

**Issue 1-3: Notes usage**

* Proposals
	+ Option 1: Proposal 6 in R4-2411237 (HW) RAN4 should discuss necessity of more practical drafting rule for NOTEs handling in a table for the future specifications.
	+ Option 2: Proposal 2 in R4-2413320: Do not use notes in tables for requirements that apply every cell/line in the table. Use text above the table instead
	+ Option 3: Proposal 6a in R4-2412482: Use “NOTE x” (with x as a number) for specific items in a table (like with superscript number) and **use “REMARK” (numbering not necessary) for note general to the table**.
	+ Option 4: Proposal 6b in R4-2412482:: Use “NOTE x” (with x as a number) for specific items in a table (like with superscript number) and **move general notes to the main body of the text with the table to which it applies to clearly mentioned.**
	+ TBA
* Recommended WF
	+ RAN4 could agree Option 1, Option 2 and Option 4. Move notes that concerns all items in the table to part of text and agree this as guideline for future

Huawei: regarding the recommended WF. We can say agree 1 2 and 4.

Nokia: It is good to have alignment. We can discuss how to implement it.

Ericsson: Option 2 is very good to use. We should implement it for early release than Rel-19.

Huawei: We can agree with Ericsson. On the future discussion, some the agreements may be applied to Rel-19 and some of them can be applied to Rel-16. It depends on future discussions.

ZTE: There are too many notes. In future the note can be merged together.

Nokia: We need include the drafting rule how to reflect notes. We need treat the proposal for note case by case.

AT&T: Agree with Nokia and Qualcomm that the examples need be provided.

Nokia: When starting discussing the existing tables, we need discuss case by case.

Agreement:

* Use Option 1, Option 2 and Option 4 as baseline, and further work on how to implement them.
	+ Companies are encouraged to provide draft examples for option 1, 2, and 4 in the next meeting.
	+ Discuss the changes for the existing tables case by case.

### Sub-topic 1-4 Tables

*Sub-topic description*

*Open issues and candidate options before meeting:*

**Issue 1-4-1: ΔTIB,c and ΔRIB,c tables**

*from R4-2410714, WF on UERF\_Spec\_Improvement*

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* Proposals
	+ Option 1: Proposal 1 in R4-2411146 (Apple): RAN4 to agree to remove the ΔRIB,c and ΔTIB,c tables in 38.101-1 and 38.101-3 and replace them by generic values based on the number of bands in the DL configuration as exemplarily shown below
	+ Option 2: Proposal 2 in R4-2411111 (CATT): RAN4 to introduce the template-based approach for simplifying ΔTIB,c and ΔRIB,c tables as Opton 3, which keeps both lexicographic order of band combinations and readability.
	+ Option 3: Proposal 2 in R4-2411237 (HW) :RAN4 shall not adopt Option 2 or similar approaches and not tighten the existing requirements for the sake of specification quality improvement.
* Recommended WF
	+ TBA, seems difficult to agree anything change since it will introduce a change of the requirements

Apple: It seems that all of companies want to changes. Is the majority of companies to propose to changes?

Huawei: From our perspective, the discussion is for the quality improvement. To change the current requirement is not desirable since it change the requirement.

ZTE: We propose to be careful to have such big changes.

Apple: Delta\_TIB and Delta\_RIB are for band combination. But anyway for single band, the insertion loss exists already. In RAN5 when doing single band verification, those delta\_TIB/RIB are used in the test? For the single band, it may be shared by different combinations.

Qualcomm: Agree with Apple. Is Huawei concern on changing the requirements or delta values?

Huawei: We have concern on both. If going with the delta values, if we try to find the agreeable values, the values would be very big. If we accommodate some band combinations, then the value would be very big. The values apply to every single band combination. To Apple, there is text when one band is included in multiple band combinations. We average the values across every band combinations.

Nokia: We already have some intends to improve it. There is no analysis. What about if we come up with some rules for the new combinations but keep the existing requirements as they are.

Moderator: It is difficult to figure out whether the band combination will be used for release or not.

Huawei: Even for new band combination, operators may not start from the two-band combinations rather high order. It may make the situation complicated. In the current specification, it is better not to change rules frequently.

ZTE: if we use two different ways for old and new ones, our motivation to simplify delta\_TIB does not exist.

OPPO: We have concern on changing values.

Moderator: With more and more combinations, the tables become problematic.

Skyworks: If Delta\_T/R cannot be verified, what is the point to have them. Delta\_T values are too small. Detal\_R can be verified via perf. The testability issue needs be addressed.

**Issue 1-4-2: MSD tables**

* Proposals
	+ Option 1: Proposal 1 in R4-2411147 (Apple): Remove the Refsens specifications in 38.101-1 clauses 7.3A.2.3, 7.3A.4, 7.3A.5, 7.3A.6, 7.3A.7 and 38.101-3 clauses 7.3B.1 and 7.3B.2.3 including the MSD tables for CA/DC combinations replacing them with a reference to the single band Refsens measurements
	+ Option 2: Proposal in R4-2413066 (Skyworks): As an initial proposal towards Option 2, we propose that Rel-19 HPUE MSD requirements for inter-band CA with an FDD HPUE band are reduced to a single set of requirements; and, this single set captures the worst-case MSD requirements. This means that RAN4 no longer has to study two sets of MSD: one set of UE supporting single Tx and another set for UEs supporting dual Tx.
		- (Option 2: Only a few contributions have been presented so far at RAN4 towards reducing our workload and the TS complexity. More studies are needed to converge towards a consensus. Some MSD are more difficult to simplify than others, e.g. MSD due to dual-UL IMD)
	+ Option 3: Proposal 1 R4-2413068 (Skyworks): Consider adopting the PC2 single Tx MSD look-up of Table 1 where the PC2 MSD is expressed as PC2 single Tx MSD = PC3 MSD + deltaPC2\_1Tx.
	+ Option 4: Proposal 2 R4-2413068 (Skyworks): Consider adopting the PC2 dualTx MSD look-up of Table 2 where the PC2 MSD is expressed as: PC2 dual Tx MSD = PC3 MSD + deltaPC2\_2Tx.
	+ Option 5: Proposal 1 R4-2413338 (Nokia) RAN4 shall consider the unified table approach for UL configurations including MSD information as presented in Table 1-9 (Page 3-5) and adopt this in the specification.
* Recommended WF
	+ Need a concrete proposal with identified and agreed problem to motivate the change will address. Could be moved to maintenance, maybe under a dedicated agenda

Moderator: the discussion should be held in Rel-19 UE RF1 WID.

Nokia: Whether to have or not have and how to do depends on the discussion. We can continue discussion in the direction of option 5.

Huawei: In our view, we agree that we should discuss it in one place. It can be discussed in RAN. To Nokia, if we discuss the table format one, it should be discussed in spec improvement. If we discuss the change the uplink configuration, it impacts the requirements.

Skyworks: support moderator view. It should be treated under one agenda. We have so many options. We need down-scope the options.

Moderator: we already have the WF in Rel-19 WID.

Nokia: We have discussed MSD in Rel-19.

Murata: We have similar view. We agree with option 3. Regarding option 4, in our view we think some cases 9dB power imbalance needs be considered. More harmonic number would be needed.

Moderator: it could be have some offline to find consensus where to discuss it.

**Issue 1-4-3: Intra-band EN-DC tables**

* Proposals
	+ Option 1: Proposal 1 in R4-2411111 (CATT): For configuration EN-DC tables, do not consider order of increasing carrier frequency for LTE and NR carriers and remove redundant symmetric table cells for each BCS as illustrated in Table - 1.
	+ Option 2: TBA
* Recommended WF
	+ Discuss further if order of component carriers has a reason

CHTTL: These changes cause some NBC issue.

ZTE: The intra-band EN-DC is not in details. What big beneficial to do this improvement. I am not sure that in the future we will have asymmetric cases.

Huawei: Postpone the discussions.

**Issue 1-4-4: Inter-band EN-DC tables**

* Proposals
	+ Option 1: Proposal 1 in R4-2411838 (ZTE): For inter-band DC configurations with FR2 part of the uplink configurations, it is proposed to optimize the configuration tables with the following grouping rules.
		- For inter-band DC configurations, the delimiter “/” could be used for the FR2 part of the uplink configurations, such as DC\_xA\_nyA/B/C, where x and ny are E-UTRA band and FR2 NR band, and A, B and C are the corresponding bandwidth classes respectively.
		- For inter-band NR-DC configurations between FR1 and FR2, the delimiter “/” could be used for the FR2 part of the uplink configurations, such as DC\_nxA\_nyA/B/C, where nx and ny are FR1 NR band and FR2 NR band, and A, B and C are the corresponding bandwidth classes respectively.
	+ Option 2: TBA
* Recommended WF
	+ Discuss further if agreeable to do the change. Maybe also need discussion on basket WI side. Good candidate for PRD on how to use the notations. Maybe at least document options in WF to see if next gen can adopt different notation

Qualcomm: OK with the proposal. But who works on the CR should be very careful not to change the requriements.

Apple: We do not see there is advantage. More downlink configurations in the same cell than uplink. If we have 50 configurations in DL and 8 UL it may reduce a bit. We have many configurations with tons of DL. The proposal makes the things complicated.

ZTE: For the solution, only uplink configuration is impacted. The downlink configurations are not impacted. To Apple, for some cases, there is no improvement. In other cases, the improvement to reduce the size of table exists. I do not see disadvantage to do it.

Nokia: We have the similar comments. It may complicate things. The information needs be abstracted. We should be careful about the changes.

Apple: We should avoid CRs. The mixture makes thing complicated.

# Topic #2: Work practice enhancements

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

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [**R4-2411112**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411112.zip) | On work practice enhancements for UE RF specs improvement | CATT | **Proposal 1: RAN4 to introduce PRD as work practice enhancement in particular on UE RF improvement discussion.** |
| [**R4-2411238**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411238.zip) | On PRD approach | Huawei, HiSilicon | Observation 1: PRDs in RAN5 do not contain technical aspects, e.g., technical recommendation, while the proposed PRDs in [R4-2407581] intend to contain technical aspects. Thus, the concept of RAN5 PRDs may not be introduced into RAN4 as they are.Observation 2: PRDs including technical instructions may impact on the outcome of T-Doc following the instructions in the PRDs. Hence, once we start the new approach, we need to commit to the sustainability of the PRDs.Observation 3: Sustainability should be ensured. Otherwise, the situation in the future may be worse than now.Observation 4: Developing and sustaining the PRDs doesn’t come for free so that the gain of the introduction of the PRDs must be positive. Hence, topic and its scope selections must need great care.Proposal 1: Before making a decision of the introduction of the PRD, we should start with a trial (the corresponding PRD is not in 3gpp ftp server) with a limited scope to check if it is manageable and the usefulness of it. Depending on the outcome, we make a decision.Proposal 2: Encourage companies to share possible areas with issues that they have encountered and expected outcome with specific details if we further discuss the introduction of the PRD in the future meetings.Observation 5: In principle, PRDs should contain the latest information and well documented in a way to give people who are not familiar with RAN4 clear instructions. Otherwise, we don’t need PRDs (A list of the approved WF would be enough).Observation 6: At least when the endorsed content for a PRD is reflected in the corresponding PRD and how do we promote utilization of the PRD should be sufficiently discussed before introducing the PRD. |
| [**R4-2413320**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413320.zip) | Specification writing and CR practices for better efficiency and transparency | Qualcomm Incorporated | **Proposal 1: Do not create hanging paragraphs even if it seems harmless at the time of creating one****Proposal 2: Do not use notes in tables for requirements that apply every cell/line in the table. Use text above the table instead****Proposal 3: Use short and clear sentences and create a table with matrix of conditions if requirement needs one****Proposal 4: If the functional objective of the requirement is already in the specification, refer to existing clauses with added conditions or expansions instead of duplicating same text or tables or figures.** **Proposal 5: Submit Cat F CR only to earliest release where feature has been specified and handle changes that have same functional objective as mirror CRs****Proposal 6: Do not included mirrored changes from eaerlier releases in the later release cat F CRs** **Proposal 7: Share MPR/AMPR proposals as matlab code as text in the submission document for verification purposes** |
| [**R4-2412482**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412482.zip) | RF specification quality improvement | Anritsu Limited | ***Observation 1: There are many undesired blank spaces in specifications. As an example, the file “38101-1-i60\_s07-XX.docx” has a number of pages that can be reduced from 197 pages to 165 pages when “Keep with next” is set to OFF.******Observation 2: Tables are over several pages long, while their header row is not repeated which can affect reading.******Observation 3: The number of notes per table is supposed to be limited, but many tables (like in TS 38.101-1) have more than 10 notes (even 48 notes but including 22 “void” notes) which is huge and make it hard for the reader.*** ***Observation 4: Some notes are sometimes very similar.******Observation 5: There are numbered notes (superscript) for both notes specific to an item in a table and general notes that apply generally to the content of the table, this makes life harder for the reader particularly for several-page-long tables as she/he needs to determine each case.******Observation 6: Some tables contain many “Note x: void” which can be annoying to the reader, particularly when superscripts are still present in a table.******Observation 7: Some tables have superscripts in different columns, it can therefore be laborious to the reader to notice some notes particularly when a table is several pages long.******Proposal 1: To remove blank space, each specification document could have all text selected and “Keep with next” set to OFF.******Proposal 2: Blank spaces like half a page long or more should be intended not unintentional. There should be the result of a “section break”.******Proposal 3: Repeat table header row at the top of each page.******Proposal 4: If there are too many notes, then either the table should be split into several tables or some of the notes should be in the main body of the document.******Proposal 5: When the same type of note is used several times in a table, it should be used either in the main body of the document or used in a special table.******Proposal 6a: Use “NOTE x” (with x as a number) for specific items in a table (like with superscript number) and use “REMARK” (numbering not necessary) for note general to the table.******Proposal 6b: Use “NOTE x” (with x as a number) for specific items in a table (like with superscript number) and move general notes to the main body of the text with the table to which it applies to clearly mentioned.******Proposal 7a: “Void” notes should be strikethrough if not applicable anymore, in order to avoid for the reader to look at their definition.******Proposal 7b: “Void” notes should be greyed out if not applicable anymore, in order to avoid for the reader to look at their definition.******Proposal 7c: “Void” notes should be deleted if not applicable anymore, in order to avoid for the reader to look at their definition, and a remark should be placed “REMARK: In TS 38.101-1 V1x.x.0 (202x-xx), the note superscript numbering was revised, and not relevant notes removed.”.******Proposal 8: When the tables are not too wide adding a NOTE column could help.*** |

## 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

*Sub-topic description:*

*Open issues and candidate options before meeting:*

**Issue 2-1: PRD usage**

* Proposals
	+ Option 1: Proposal 1 in R4-2411112 (CATT): RAN4 to introduce PRD as work practice enhancement in particular on UE RF improvement discussion.
	+ Option 2: R4-2411238 (HW): Proposal 2: Encourage companies to share possible areas with issues that they have encountered and expected outcome with specific details if we further discuss the introduction of the PRD in the future meetings.
* Recommended WF
	+ RAN4 rapporteurs to come up with a concrete proposal on the scope of the first PRD and define a proposal within a WI/SI.

Huawei: The direction is OK. We do not need to restrict who will come up with proposals. Companies are encouraged to provide the concrete proposal. We are asking people to provide the proposals on the PRD.

ZTE: Will we agree the technique issues in PRD? In RAN5, PRD is just information. There is no technique issue. If we approve the technique issue in PRD, what difference from TR.

Nokia: It is not possible to have continuing between release. From our side, it is good idea to have PRD to provide information.

Huawei: At least that TR requires WI or SI. PRD is independent from WI and SI. It can be used to provide generic information to the group. We can discuss the scope of PRD and timeline.

AT&T: Support to use PRD to set instruction. It is widely used in RAN5.

Nokia: Agree with comments from Huawei. Before we start PRD, make sure that we will update it and make it useful.

Moderator: The recommended WF is based on majority of companies.

Huawei: we may see different proposals in the next meeting and should prioritize what objectives in the PRD. We can ask companies to provide the purpose to PRD.

AT&T: We need propose the skeleton for PRDs.

ZTE: we should decide with title of PRD that we want to make contribution now. With the title we can select the objectives for PRD. We need number PRD documents.

Moderator: it is not be good idea to have many number of PRD. Suggest that basket rapporteur to provide input for the first PRD.

Skyworks: We need have target for the first PRD. We created document that we could not update. It could be based on the existing work.

Huawei: We are OK to discuss PRD for band combination. We do not need restrict that others express the view.

Agreement:

* Companies come up with concrete proposals on the scope of the first PRD for band combinations with PRD skeleton, if possible.
	+ Ericsson can lead the discussions for the first PRD.
* Based on the initial version of PRD, RAN4 will decide whether to have PRD and how to organize the discussions.

### Sub-topic 2-2

**Issue 2-2: Mirror CRs**

* Proposals
	+ Option 1: Proposal 5 in R4-2413320: Submit Cat F CR only to earliest release where feature has been specified and handle changes that have same functional objective as mirror CRs
	+ Option 2: TBA
* Recommended WF
	+ Follow and enforce what is Chairs guidance allready

Huawei: I would like to check that if following this, the number of CRs will be increased.

# Topic #3: Larger specification structure enhancements

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

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [**R4-2411113**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411113.zip) | On larger specification structure enhancements for UE RF specs improvement | CATT | **Proposal 1: As Option 3, RAN4 to consider the following modified suffix-based approach as a larger specs structure enhancement for UE RF specs:**

|  |
| --- |
| 5 Operating bands and channel arrangement5A Operating bands and channel arrangement for CA6 Transmitter characteristics 6A Transmitter characteristics for CA7 Receiver characteristics 7A Receiver characteristics for CA |

**Proposal 2: RAN4 to study how to introduce better structure organization on specification for composite feature and primitive feature in future standardization.** |
| [**R4-2411239**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411239.zip) | Necessity of key aspects to select a specification structure | Huawei, HiSilicon | Observation: In order to decide which specification structure option RAN4 adopts and to develop a new specification structure(s) if any, RAN4 may need key aspects/criteria for evaluation for each of the candidate specification structures.Proposal: RAN4 should discuss possible key aspects to evaluate and compare each of the possible specification structures before selecting one specification structure when developing new specifications like 6G. |
| [**R4-2413317**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413317.zip) | Further considerations on specification structure enhancement | ZTE Corporation, Sanechips | *Optimization at this stage.***Proposal 1. It is suggested to add a number for the constituent sub-file name in the zip file so as to have the zip file in order (See figure 2) with blue colour highlighted.****Proposal 2. It is suggested to fix or add the missing definitions, symbols and abbreviations in the spec.***Optimization for future spec structure.***Proposal 3. For future spec structure optimization, it can be optimized with the guidelines as below.*** **Re-organize the specification zip file by the features, each of the constituent sub-file specifies a certain feature, such as single carrier, CA, DC, etc.**
* **All of the requirements corresponding to a certain feature will be specified in a certain sub-file.**
* **In each sub-file, the clauses could be further specified with a second level sub-clause to reflect the requirements of a sub-feature.**
* **Capture the above optimization as one of the candidate for future spec structure.**
 |

## 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 3-1 Clause structures

*Sub-topic description:*

*Open issues and candidate options before meeting:*

**Issue 3-1: Clause structure for next phase**

* Proposals
	+ Option 1: Proposal 1 in R4-2411113 (CATT): As Option 3, RAN4 to consider the following modified suffix-based approach as a larger specs structure enhancement for UE RF specs
		- Uses suffix at heading 1 level
	+ Option 2: Proposal in R4-2411239 (HW): RAN4 should discuss possible key aspects to evaluate and compare each of the possible specification structures before selecting one specification structure when developing new specifications like 6G.
* Recommended WF
	+ Discuss but agreement maybe difficult since scope is not next generation

### Sub-topic 3-2 File structures

*Sub-topic description*

*Open issues and candidate options before meeting:*

**Issue 3-2: File structure (can be for this or future generation)**

* Proposals
* Option 1: Proposal 1 in R4-2413317 (ZTE). It is suggested to add a number for the constituent sub-file name in the zip file so as to have the zip file in order (See figure 2) with blue colour highlighted.
* Option 2: Proposal 3. For future spec structure optimization, it can be optimized with the guidelines as below.
	+ Re-organize the specification zip file by the features, each of the constituent sub-file specifies a certain feature, such as single carrier, CA, DC, etc.
	+ All of the requirements corresponding to a certain feature will be specified in a certain sub-file.
	+ In each sub-file, the clauses could be further specified with a second level sub-clause to reflect the requirements of a sub-feature.
	+ Capture the above optimization as one of the candidate for future spec structure.
* Recommended WF:
	+ Discuss further and hear MCC input for current generation

Huawei: Option 1 is not essential. Regarding option 2, if there are changes across features, we have to open every files in zip which is not convenient. We cannot agree with option 2.

AT&T: MCC uses the consistent way to handle. We do not support option 2.

ZTE: Regarding option 1, we can do it in the current release. For option 2, there is a big impact, which needs be handled in future.

Nokia: we cannot agree on Option 2. It is not simplification. For Option 1, it is not possible.

CATT: we are talking about the potential improvement for the future. We do not need any agreement. We just need capture the proposal. For each feature, it should be self contained.

Moderator: I believe that it is not like RAN4 discussions at all.

R&S: What is the possible to generate pdf version?