**3GPP TSG-RAN WG4 Meeting # 111 R4-2408950**

**Fukuoka, Japan, May 20th ‒ 24th, 2024**

**Agenda item:** 12.1

**Source:** Moderator(Qualcomm)

**Title:** Topic summary for [111][139] UERF\_Spec\_Improvement

**Document for:** Information

# Introduction

This is topic summary for RAN task based on WF RP-240782 from RAN#103 for part that covers TS 38.101-1/2/3.

# 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** |
| [**R4-2407225**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407225.zip) | Simplifying RX/TX RF Refsens/Pout tables | Apple | Observation 1: For inter-band NR-CA and EN-DC the ΔRIB,c and ΔTIB,c values do not represent the underlying insertion loss values but are derived by negotiations between companies in 3GPP.Observation 2: The real losses of the RF Frontend heavily depend on the number of supported bands, band combinations, the architecture and the technology used. This is not represented in ΔRIB,c and ΔTIB,c.***Proposal 1****: Remove the* ΔRIB,c and ΔTIB,c *tables and replace them by generic values based on the number of bands in the DL configuration* ***Proposal 2****: Use these generic values for* ΔRIB,c and ΔTIB,c *:**ΔRIB,c:**2 bands: 0.0dB**3 bands: 0.2dB**4 bands: 0.3dB**5 bands: 0.4dB**6 bands: 0.5dB**ΔTIB,c**2 bands: 0.1dB**3 bands: 0.2dB**4 bands: 0.3dB**5 bands: 0.4dB**6 bands: 0.5dB* |
| [**R4-2407542**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407542.zip) | Table modifications for UE RF specs improvement | CATT | Proposal 1: RAN4 to introduce a template-based approach to improve UE RF specs quality.Proposal 2: For the NR CA band combination tables, RAN4 to introduce the template “CA\_nA-nB [DL interruption allowed]” and simplify the tables with a rule that each row in the new NR CA band table has an “index” band and includes all band combinations consisting of the index band in a lexicographical order, and the index bands among rows are also in the lexicographical order for the sake of readability. |
| [**R4-2407582**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407582.zip) | UE RF specification technical corrections for CA and MIMO | Qualcomm Incorporated | Proposal 1: Update all uplink inter-band CA requirements to align with RAN1 specifications to apply when there are simultaneous transmission occasions on two bands.Proposal 2: Intra-band contiguous CA requirements apply when UE is confgired/activated for two uplink CCsProposal 3: Intra-band non-contiguous CA requirements apply based on allocation when dualPA=1 and based on configuration/activation when dualPA=0.Proposal 4: RAN4 to update specification language according to proposal 1,2 and 3. Proposal 5: DualTX reference in conjunction with PC1.5 should be updated to refer to TxDProposal 6: Dual TX in conjunction with UL MIMO should be updated to refer to the UE supporting two antenna ports.Proposal 7: RAN4 to study how the UL MIMO section requirements should be explicitly defined to rely on terminology aligned with other work groups |
| **[R4-2407625](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407625.zip)** | Views on technical wording ambiguities and table modifications for spec improvement | Samsung,CHTTL | 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: Discuss and confirm the following understanding:- “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 “2Tx 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 either “2Tx-TxD” or “4Tx-TxD”, it is easy to judge which it is based on the context.\Proposal 2: If Proposal 1 can be confirmed, further discuss whether to add general clarification in Clause 4, for “Dual Tx”.Proposal 3: Do not consider the following Table simplification for FR1+FR2 EN-DC, unless there is clear benefit foreseenProposal 4: Do not consider the following approach for Table simplification as the readability is dramatically decreased in exchanging for reducing the spec length by 13 pages.Proposal 5: RAN4 to clarify what is the correct interpretation for “If the bit is not set” in Table L.1-1 of 38.101-1. Improve the spec wording if necessary. |
| **[R4-2407688](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407688.zip)** | On table modifications and technical wording ambiguities | Huawei, HiSilicon | Observation 1: For the proposal by [R4-2404896], if we go with this approach, a way of the changes in right column should be appliable to the left column. Otherwise, people may wonder if e.g., DC\_2A-n258A in both left and right has the same meaning or not. Simplifying only one of the columns limits effectiveness against shortening the entire table. Also, it’s noted that an explanation on how to interpret subsequent “/” somewhere in the specification.Observation 2: For the proposal by [R4-2404448], the proposal can significantly reduce the number of rows of tables, while readability could be lost. Probably, repeatedly inserting n1 in band combination starting from CA\_n1-nX, CA\_n1-nY, CA\_n1-nZ…, may make readers difficult to find a targeted band combination.Observation 3: The proposal by [R4-2404448] cannot fit to band combinations with more than two bands as it is, since for band combinations with more than two bands, if a CA band combination has uplink band combinations with NO interruption, the other uplink band combinations for the CA band combination still may allow to have interruption. Hence, this information cannot be captured by simply putting “No” as proposed in [R4-2404448].Observation 4: Whatever table simplification for band combination/configuration is taken, it would be better to have consistency across specifications as much as possible.**Proposal 1**: Consider following table format as one of the candidates.Table 5.2A.2.2-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |
| --- | --- |
| NR CA Band | DL interruption allowed (Note 4) |
| Combination | Possible values of X for each combination |
| CA\_n1-n3-n”X” | 5, 7, 8, 18, 26, 28, 38, 40, 413, 75, 77, 783, 4, 793, 105 | X= 78; No for CA\_n1-n78, CA\_n3-n78 |
| CA\_n1-n5-n”X” | 7, 26, 40, 784, 79 | X =78; No for CA\_n1-n78, CA\_n5-n78 |

If the above is applied to Table 5.5B.5.1-1, it can be seen as follows.5.5B.5.1-1: Inter-band EN-DC configurations including FR2 (two bands): Inter-band CA operating bands involving FR1 (three bands)

|  |  |
| --- | --- |
| EN-DC configuration | Uplink EN-DC configuration(NOTE 1) |
| Configuration | Possible values of X for each configuration |
| DC\_2A\_n258”X” | A, D, H, I, J, K, L, M, O, P, Q | A, D, H, I, J, K, L, M, O, P, Q |

**Observation 5**: Proposal 1 can minimize spec changes for an introduction of a new band combination and avoid errors due to misusing “-“, “\_” as well as missing “n” when a CR is prepared.**Proposal 2**: Consider following table formats as one of the candidates.* For ΔTIB,c or ΔRIB,c, tables are structured not per band combination per row, but rather than per relaxation value combination (value in band A and value in band B and so on) per row.
* For MSD due to IMD, tables are structured not two or three rows per MSD, but rather one row per MSD.

**Proposal 3**: Discussion on fixing wording ambiguity specific to certain features and/or requirements like MSD should be discussed under a different agenda item(s) on a case-by-case basis if the discussion requires technical discussion. |
| [**R4-2407724**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407724.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.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. |
| [**R4-2409190**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409190.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 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. |
| [**R4-2409510**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409510.zip) | Further considerations on band combination configuration tables with FR2 component bands | ZTE Corporation, Sanechips | Observation 1 For inter-band CA configurations with FR2 part of the uplink configurations, grouping rules have been made in current spec for the configurations by using the delimiter “/” in uplink CA configurations, such as CA\_nxA-nyA/B/C denotes CA\_nxA-nyA, CA\_nxA-nyB and CA\_nxA-nyC, where nx and ny are two NR bands, ny is a FR2 band and A, B and C are the corresponding bandwidth classes respectively. However, for inter-band EN-DC configurations, there are no such grouping rules and the uplink EN-DC configurations are listed individually without using the delimiter “/”.Proposal 1 For inter-band DC configurations with FR2 part of the uplink configurations, it is proposed to optimize the configuration tables with the grouping rules as below.­ For inter-band EN-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.­ The above optimization rules could be applied starting from Rel-18.Observation 2 With the optimization in Proposal 1, we see that the following benefits can be foreseen. More concise and readable uplink configurations. Same grouping rules on uplink as inter-band CA configurations. Reduced configuration table size. No information lost in the optimization.Observation 3 For inter-band EN-DC configurations, the downlink configurations are grouped with the configurations having the same component frequency bands in current RAN4 spec. If multiple UL DC configurations are listed for multiple DL DC configurations, valid uplink configurations are such that uplink does not have more carriers than downlink. However, there are no similar grouping rules for inter-band CA configurations.Proposal 2 For inter-band CA configuration having FR2 component band, it is proposed to group the configurations with the guidelines as below.­ For the configurations having the same component NR\_Band, same CHBW and same BCS number in <DL\_CA, UL\_CA, NR\_Band, CHBW, BCS>, the multiple DL CA configurations could be grouped with the UL CA configurations if the UL configurations of higher order band combination are the superset of the UL configurations of lower order band combination.­ If multiple UL CA configurations are listed for multiple DL DC configurations, valid uplink configurations are such that uplink does not have more carriers than downlink.­ The inter-band CA configurations with a non-contiguous CA part and inter-band CA configurations with a contiguous CA part are listed in different groups.­ The CA configurations are grouped within one fallback group (FBG) except for the single CC bandwidth class.­ It is supposed to apply the above guidelines starting from Rel-19.Proposal 3 For band combination operating band, it is proposed to optimize the table with the guidelines as below.­ Keep the current table format as it is now in the spec and remove the obviously redundant rows in which the “DL interruption allowed” column is absent.­ Add a note to indicate that all inter-band CA configurations supported in clause 5.5A.3 are not explicitly listed in the table if “DL interruption allowed” is absent.­ The above guidelines can be applied to inter-band CA configurations. For the other types of band combinations, since the table size is not too large, keep the current table template as it is.Observation 4 In most cases the UE relaxation values are dependent on the type of issues such as harmonics, intermodulation, etc. which is highly correlated with the involving frequency bands. The relaxations are always duplicated among different types of band combinations in current specs.Proposal 4 For the UE relaxation tables for different types of band combination, it is proposed to optimize the spec with the guidelines as below.­ Create a new separate spec to collect all common issues which are independent to the band combination types.­ If the value for a certain band combination type is different from which collected in the common spec, it can be specified in its own spec, otherwise, the value in the common spec will be reused.­ The proposed changes can be implemented after Rel-19. |
| [**R4-2407419**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407419.zip) | On simplifying MSD value specification and test | Skyworks Solutions Inc. | Proposal for study in Release 19:• Instead of a number with tenth of dB accuracy, minimum requirement MSD is specified in terms of MSD class II to VIII by replacing the evaluated values from single contribution or averaged multiple contribution to the related lower MSD capability class.• Minimum requirement MSD class I is not specified.• For minimum requirement MSD evaluated above 22dB, a >22dB value is used in the specification and it is recommended to RAN5 than this is not tested unless the UE declares a lower capability class.• It can be further studied if some specific lower-MSD capability class value may always apply for the minimum requirement of a given case: for UL5/DL1 MSD for example or for a given IMD order. |

## Open issues summary

### Sub-topic 1-1 Specification table simplification

Sub-topic description:

*Open issues and candidate options before meeting:*

**Issue 1-1-1:** Simplification ofTable 5.2A.2.1-1: Inter-band CA operating bands involving FR1 (two bands) (from R4-2404448)

* Proposals
	+ **(R4-2407542, CATT) Proposal 2**: For the NR CA band combination tables, RAN4 to introduce the template “CA\_nA-nB [DL interruption allowed]” and simplify the tables with a rule that each row in the new NR CA band table has an “index” band and includes all band combinations consisting of the index band in a lexicographical order, and the index bands among rows are also in the lexicographical order for the sake of readability.
	+ **(R4-2407625, Samsung) Proposal 4**: Do not consider the following approach for Table simplification as the readability is dramatically decreased in exchanging for reducing the spec length by 13 pages.
	+ **(R4-2407688, Huawei) Proposal 1**: Consider following table format as one of the candidates.
* Table 5.2A.2.2-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |
| --- | --- |
| NR CA Band | DL interruption allowed (Note 4) |
| Combination | Possible values of X for each combination |
| CA\_n1-n3-n”X” | 5, 7, 8, 18, 26, 28, 38, 40, 413, 75, 77, 783, 4, 793, 105 | X= 78; No for CA\_n1-n78, CA\_n3-n78 |

* + **(R4-2409510, ZTE Corporation) Proposal 3** For band combination operating band, it is proposed to optimize the table with the guidelines as below.
* Keep the current table format as it is now in the spec and remove the obviously redundant rows in which the “DL interruption allowed” column is absent.
* Add a note to indicate that all inter-band CA configurations supported in clause 5.5A.3 are not explicitly listed in the table if “DL interruption allowed” is absent and no note exists in the table.
* The above guidelines can be applied to inter-band CA configurations. For the other types of band combinations, such as operating bands for SUL and operating bands for UL MIMO, etc., since the table size is not too large, keep the current table template as it is.
* Recommended WF
	+ Discuss views, if no consensus consider **(R4-2407625, Samsung) Proposal 4**

**Issue 1-1-2:** Simplification ofTable 5.2A.2.1-1: Inter-band CA operating bands involving FR1 (two bands) (from proposal by [R4-2404896)

* Proposals
* **(R4-2407688, Huawei) Proposal 1**: Consider following table format as one of the candidates.
	+ 5.5B.5.1-1: Inter-band EN-DC configurations including FR2 (two bands): Inter-band CA operating bands involving FR1 (three bands)

|  |  |
| --- | --- |
| EN-DC configuration | Uplink EN-DC configuration(NOTE 1) |
| Configuration | Possible values of X for each configuration |
| DC\_2A\_n258”X” | A, D, H, I, J, K, L, M, O, P, Q | A, D, H, I, J, K, L, M, O, P, Q |

* **(R4-2407625, Samsung) Proposal 3:** Do not consider the following Table simplification for FR1+FR2 EN-DC, unless there is clear benefit foreseen
* **(R4-2409510, ZTE Corporation) Proposal 1**: For inter-band DC configurations with FR2 part of the uplink configurations, it is proposed to optimize the configuration tables with the grouping rules as below.
	+ For inter-band EN-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.
	+ The above optimization rules could be applied starting from Rel-18.
* Recommended WF
	+ Discuss views, if no consensus, consider **(R4-2407625, Samsung) Proposal 3**

### Sub-topic 1-2 MSD simplification

**Issue 1-2-1:** Simplification receiver relaxations tables

* Proposals
	+ **(**[**R4-2407225**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407225.zip)**, Apple) Proposal 1**: Remove the ΔRIB,c and ΔTIB,c tables and replace them by generic values based on the number of bands in the DL configuration
		- Moderators note, we can discuss proposal 2 if prop 1 is agreeable
	+ **(R4-2407419, Skyworks) Proposal** for study in Release 19:
		- Instead of a number with tenth of dB accuracy, minimum requirement MSD is specified in terms of MSD class II to VIII by replacing the evaluated values from single contribution or averaged multiple contribution to the related lower MSD capability class.
		- Minimum requirement MSD class I is not specified
		- For minimum requirement MSD evaluated above 22dB, a >22dB value is used in the specification and it is recommended to RAN5 than this is not tested unless the UE declares a lower capability class.
		- It can be further studied if some specific lower-MSD capability class value may always apply for the minimum requirement of a given case: for UL5/DL1 MSD for example or for a given IMD order.
	+ **(R4-2407688, Huawei) Proposal 2**: Consider following table formats as one of the candidates.
		- For ΔTIB,c or ΔRIB,c, tables are structured not per band combination per row, but rather than per relaxation value combination (value in band A and value in band B and so on) per row.
		- For MSD due to IMD, tables are structured not two or three rows per MSD, but rather one row per MSD.
	+ **(R4-2409510, ZTE Corporation) Proposal 4**. For the UE relaxation tables for different types of band combination, it is proposed to optimize the spec with the guidelines as below.
		- Create a new separate spec to collect all common issues which are independent to the band combination types.
		- If the value for a certain band combination type is different from which collected in the common spec, it can be specified in its own spec, otherwise, the value in the common spec will be reused.
		- The proposed changes can be implemented after Rel-19.
* Recommended WF
	+ Work on CR merging **(**[**R4-2407225**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407225.zip)**, Apple) Proposal 1** and **(R4-2407688, Huawei) Proposal 2**
	+ Continue discussions on MSD tables

### Sub-topic 1-3 Wording ambiguities

**Issue 1-3-1:** CA requirement applicability

**Proposals**

* **(R4-2407688, Huawei) Proposal 3**: Discussion on fixing wording ambiguity specific to certain features and/or requirements like MSD should be discussed under a different agenda item(s) on a case-by-case basis if the discussion requires technical discussion.
* **(R4-2407724, Ericsson) 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.
* **(R4-2407724, Ericsson) 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
* **(R4-2407582, Qualcomm Incorporated) Proposal 1**: Update all uplink inter-band CA requirements to align with RAN1 specifications to apply when there are simultaneous transmission occasions on two bands.
* **(R4-2407582, Qualcomm Incorporated) Proposal 2**: Intra-band contiguous CA requirements apply when UE is confgired/activated for two uplink CCs
* **(R4-2407582, Qualcomm Incorporated) Proposal 3**: Intra-band non-contiguous CA requirements apply based on allocation when dualPA=1 and based on configuration/activation when dualPA=0.

**Recommended WF**

 Discuss views but either continue here or in power class agenda. Not both.

**Issue 1-3-2:** dual TX

Proposals:

* **(R4-2407582, Qualcomm Incorporated) Proposal 5:** DualTX reference in conjunction with PC1.5 should be updated to refer to TxD
* **(R4-2407582, Qualcomm Incorporated) Proposal 6:** Dual TX in conjunction with UL MIMO should be updated to refer to the UE supporting two antenna ports.
* **(R4-2407625, Samsung) Proposal 1**: Discuss and confirm the following understanding:
	+ - “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 “2Tx 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 either “2Tx-TxD” or “4Tx-TxD”, it is easy to judge which it is based on the context.\
* **(R4-2407724, Ericsson) Proposal 3**: state in the general clause 6.1 that the notions “dual TX” and “2Tx” etc all refer to two Tx antenna connectors.

**Recommended WF**

Proceed with CRs based on **(R4-2407724, Ericsson) Proposal 3**

**Issue 1-3-3:** Modified MPR language

Proposals:

* **(R4-2407625, Samsung) Proposal 5**: RAN4 to clarify what is the correct interpretation for “If the bit is not set” in Table L.1-1 of 38.101-1. Improve the spec wording if necessary

**Recommended WF**

 Discuss views

# Topic 2: Work practice enhancements

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [**R4-2407543**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407543.zip) | Work practice enhancements for UE RF specs improvement | CATT | Proposal: In order to ensure sufficient attention and efforts on maintenance CRs, RAN4 to consider the following measures:• Permit only draft CRs to be submitted prior to each RAN4 meeting;• During each meeting, a dedicated evening ad hoc session can be designated to discuss and review all endorsed draft CRs from the previous meeting for each RAN4 specification;• The outcome of this ad hoc session would be the formal assignment of CRs by RAN4 leadership in each meeting. |
| [**R4-2407581**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407581.zip) | Adoption of PRDs in RAN4  | Qualcomm Incorporated | Observation 1: Specification structure with suffix use inheritedObservation 2: Frameworks for band combination specific relaxations are poorly documentedProposal: Ran4 to adopt use to Permanent Reference Documents |
| [**R4-2407689**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407689.zip) | On how to proceed with spec improvement work | Huawei, HiSilicon | Observation 1: Proposals in RAN4#110bis [R4-2405294] could be roughly divided into two directions of resolutions. One is directly improving specification quality, e.g., simplification of tables, and the other is indirectly improving the quality via RAN4 workload reduction, e.g., allowing CRs submission from only a certain release onward etc.Proposal 1: First priority should be directly improving specification quality given that in the end, it reduces RAN4 workload as well. A way of indirectly improving specification quality should be carefully handled if introduced.Observation 2: A way of directly improving specification quality could be divided into three areas. 1 Specification structure changes including unifying tables in a clause or across clauses etc2 Accurate word choice to avoid wording ambiguity3 Specification simplification, e.g., minimizing size of tables, simplifying table format, etc Observation 3 Changing specification structure or unifying tables must not be the option to take for the existing specifications as discussed in our companion paper of [R4-2407690] Observation 4: Addressing spec improvement that requires technical discussion is challenging under this agenda item. Because many other different technical issues may come up randomly, the degree of the challenges is different so that it would be more appropriate to handle them on a case-by-case basis like power class issue if needed.Observation 5: The number of CRs for each specification is 38.101-1 > 38.101-3 > > 38.101-2. A possible difference between 38.101-1 and 38.101-3 is -1 has more specific features than -3. Most of the CRs for 38.101-3 are for a kind of basket WIs. At least lengthy tables in -1 and -3 would make 38.101-1 or -3 have more CRs than -2.Proposal 2: Under this agenda item, when we discuss a way of directly improving specification quality, - Focus is simplification of specification which do not require specific technical discussion, more specifically, e.g., thorough table format simplification for band combination/configuration and accompanied relaxation values.- Fixing wording ambiguity specific to certain features and/or requirements like MSD should be discussed under a different agenda item(s) on a case-by-case basis if the discussion requires technical discussion.- Do not discuss specification structures or unifying tables in a clause or across clauses Observation 6: Rel-18 correction CRs dominate the number of CRs across release. Observation 7: Setting rules such that capping the number of t-docs, permission rules for maintenance CR are difficult to agree with the details, it may hurt the quality, since even if we find a critical flaw(s), it cannot be fixed later.Proposal 3: Do not set rules such that capping the number of t-docs sharp or permission rules for early release maintenance CR.Observation 8: Setting rules such that capping the number of t-docs, permission rules for maintenance CR are difficult to agree with the details, it may hurt the quality, since even if we find a critical flaw(s), it cannot be fixed later.Proposal 4: Do not set rules such that capping the number of t-docs sharp or permission rules for early release maintenance CR.Observation 9: There are cases that companies take two steps meaning that draft CRs/TPs for DL CA and UL CA are submitted at different times. This makes the number of t-docs increase and would invite more errors.Observation 10: Many editorial CRs to improve RAN4 specification quality are submitted specifically after next Sep Observation 11: There are cases that the changes in the agreed CRs were not correctly reflected into specifications. Proposal 5 : Allowing spec rapporteurs to collect following changes and prepare draft CR(s) before RAN4 submission deadline and agree them without seeing it during the meeting. The detail is FFS.• Editorial changes- Aligning mathematical notations- Ensuring that abbreviations are defined, referenced and consistent- Correcting mis-spellings and minor English language changes• Corrections of errors which were slip into specifications on the way to implementing the agreed CRs into them |
| [**R4-2408493**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408493.zip) | UE specification working procedures | Ericsson | * Allocation of agenda item and TUs to discuss/coordinate the spec framework /impacts for new feature and the dependency with other already standardized features before agreeing the formal CR and/or during the maintenance phase.
* Creating of a practice of creating a “CR implementation plan”
* For situations where similar text needs to be repeated across multiple sections (or specifications), the general text could firstly be agreed as a reference and then used across different sections/CRs/specifications to improve consistency.
* Creating a written “language consistency review” template
* Creation of a repository available on 3GPP servers of figure templates, editable diagrams and formulae
* For basket WIs, formalization of a few days period for review of the spec implementation prior to publishing, with the opportunity to quickly fix errors if found.
* Simplification of the cover-sheet and procedures
* At the start of a new generation and for larger WIs, do a cross check with RAN5 that the RAN4 specification structure is likely to eventually lend itself well to well organized RAN5 specifications.
 |

## Open issues summary

### Sub-topic 1-3 Specification table simplification

**Issue 2-1-1: PRDs**

* Proposals
	+ (**R4-2407581, Qualcomm) Proposal**: Ran4 to adopt use to Permanent Reference Documents
* Recommended WF
	+ (**R4-2407581, Qualcomm) Proposal** Ran4 to adopt use to Permanent Reference Documents. Deatails and scope FFS

**Issue 2-1-2: Scope of this activity**

* Proposals
	+ **(R4-2407689, Huawei,) Proposal 1:** First priority should be directly improving specification quality given that in the end, it reduces RAN4 workload as well. A way of indirectly improving specification quality should be carefully handled if introduced.
	+ **(R4-2407689, Huawei,) Proposal 2:** Under this agenda item, when we discuss a way of directly improving specification quality,
		- Focus is simplification of specification which do not require specific technical discussion, more specifically, e.g., thorough table format simplification for band combination/configuration and accompanied relaxation values.
		- Fixing wording ambiguity specific to certain features and/or requirements like MSD should be discussed under a different agenda item(s) on a case-by-case basis if the discussion requires technical discussion.
		- Do not discuss specification structures or unifying tables in a clause or across clauses
* Recommended WF
	+ **(R4-2407689, Huawei,) Proposal 2**

**Issue 2-1-3: General work practices**

* Proposals
	+ **(R4-2407543, CATT) Proposal:** In order to ensure sufficient attention and efforts on maintenance CRs, RAN4 to consider the following measures:
		- Permit only draft CRs to be submitted prior to each RAN4 meeting;
		- During each meeting, a dedicated evening ad hoc session can be designated to discuss and review all endorsed draft CRs from the previous meeting for each RAN4 specification;
		- The outcome of this ad hoc session would be the formal assignment of CRs by RAN4 leadership in each meeting.
	+ **(R4-2407689, Huawei) Proposal 3:** Do not set rules such that capping the number of t-docs sharp or permission rules for early release maintenance CR.
	+ **(R4-2407689, Huawei) Proposal 4:** Allowing spec rapporteurs to collect following changes and prepare draft CR(s) before RAN4 submission deadline and agree them without seeing it during the meeting. The detail is FFS.
		- Editorial changes
			* Aligning mathematical notations
			* Ensuring that abbreviations are defined, referenced and consistent
			* Correcting mis-spellings and minor English language changes
			* Corrections of errors which were slip into specifications on the way to implementing the agreed CRs into them
	+ **(R4-2407689, Huawei) Proposal 5** : Discuss a way to give delegates more opportunities and/or time to review draft specifications.
		- One possible way could be taking two steps, review by the authors of the agreed CRs, and then, review by all the interested people
	+ **(R4-2408493, Ericsson)**
		- Allocation of agenda item and TUs to discuss/coordinate the spec framework /impacts for new feature and the dependency with other already standardized features before agreeing the formal CR and/or during the maintenance phase.
		- Creating of a practice of creating a “CR implementation plan”
		- For situations where similar text needs to be repeated across multiple sections (or specifications), the general text could firstly be agreed as a reference and then used across different sections/CRs/specifications to improve consistency.
		- Creating a written “language consistency review” template
		- Creation of a repository available on 3GPP servers of figure templates, editable diagrams and formulae
		- For basket WIs, formalization of a few days period for review of the spec implementation prior to publishing, with the opportunity to quickly fix errors if found.
		- Simplification of the cover-sheet and procedures
		- At the start of a new generation and for larger WIs, do a cross check with RAN5 that the RAN4 specification structure is likely to eventually lend itself well to well organized RAN5 specifications.
* Recommended WF
	+ Discuss views

# Topic 3: Larger specification structure enhancements

|  |  |  |  |
| --- | --- | --- | --- |
| **TDoc** | **Title** | **Company** | **Proposals / Observations** |
| [**R4-2407544**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407544.zip) | Larger specs structure enhancements for UE RF specs improvement | CATT | Observation 1: The current suffix-based approach in UE RF specs offers advantages of having aligned headers for all requirements for different features, and disadvantage of spreading requirements across different sub-clauses for a specific feature.Observation 2: Option 2 has a merit of having a self-contained clause dedicated for a specific feature, however, requirements do not have aligned headers for all requirements for different features, and a significantly increased number of chapters is required as well.Proposal: 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 |

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| [**R4-2407690**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407690.zip) | On specification structures | Huawei, HiSilicon | Observation 1: There are many cross-referenced clauses and/or tables within the same specification.Observation 2: There are many cross-referenced clauses and/or tables across the specifications, e.g., 38.101-1, 38.101-2 and 38.101-3, 38.133 and even specifications for other WGs, e.g., 38.331 and 38.306.Observation 3: Restructuring requires multiple steps- From which feature(s) and specification(s) we start the restructuring- All cross-referenced clauses and/or table number in the specifications need be identified- Then, all the changes in all the specifications shall be fixed at the same time- It is noted that the third bullet must be performed across WGsObservation 4: Requirements for new features have been introduced even during the restructuring, which means that changes in the CRs for those features shall be synchronized with the CRs for restructuring.Proposal 1: Do not adopt Option 2 for the existing specifications.Proposal 2: Keep both Option 1 and Option 2 as candidate in case RAN4 discusses specification structures for new specifications, e.g., 6G.From R4-2406709(**Option 1**: the framework used in current 4G and 5G spec. (i.e. The same requirements for different features are packed in the second sub-clause together.)**Option 2**: All of (additional) requirements for each feature could be packed together.) |
| [**R4-2407987**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407987.zip) | Specification structure enhancement | LG Electronics | Proposal 1: Consider Option 3 as specification structure enhancement. Option 3: Reorderding all of requirements for each feature could be packed together. |
| [**R4-2408073**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408073.zip) | Views on larger specification structure enhancements | SAMSUNG R&D INSTITUTE JAPAN | Observation 1: No critical issues identified for RAN4 UE RF specifications from spec structure perspective. Proposal 1: RAN4 shall avoid to have big specification structure change for NR specifications at this late stage.Proposal 2: Considering diverse and uncertainty of different WIs/features and accumulated sections with new WIs/features, not treating WIs/Features as a generic item to divide sections. WIs/features can be treated case by case when corresponding requirements introduced.Observation 2: RAN4 has spent a lot of time to specify requirements for every single combination including new bands, CA/DC, and or new power classes. Observation 3: It’s challenge to handle band combinations based on existing CA/DC framework for 6G considering potential combinations among 3 RATs and 3 frequency ranges.Proposal 3: For 6G preparation, RAN4 shall further study new framework/specification structure for the introduction of new bands/frequency ranges, CA/DC, and or new power classes. Proposal 4: Introduce UE RF sub-specifications or main chapters based on test methodologies (similar as UE demodulation specification TS 38.101-4 and BS specification TS 38.104):• Conductive Tx/Rx characteristics / TS xx.xxx-1 Conductive UE RF requirements • Radiated Tx/Rx characteristics/TS xx.xxx-2 Radiated UE RF requirements• Requirements for interworking/TS xx.xxx-3 UE RF requirements for inter-working |
| [**R4-2408720**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408720.zip) | Larger future specification structure enhancements for UE RF | Nokia | Observation 1: Current way of defining single band operation in terms of what requirements are defined is quite good and no big problems are identified.Observation 1-1: NR concept for band numbering has proven successful and very usable. This concept means that 3G, 4G, and 5G use same band number if frequency arrangement is same but NR has prefix on “n”. For 6G we could re-use prefix concept and just pic a new letter, for example “s”.Observation 1-2: At least NR FR1 channel bandwidths need to be specified i.e. 3, 5, 10, 15…90, 95 and 100 MHz, in increments of 5 MHz (with 3MHz being the exception to the rule needed for specific low-bandwidth deployments). What to define beyond 100 MHz needs discussion but for FR1 up to 200 MHz can be foreseen. Additionally, no other table should list channel bandwidths, but reference the only table that contains the definitions.Observation 1-3: There is clearly an operator need for asymmetric CH BWs based on experience of NR and LTE. This should be made possible in 6G without a need for asymmetric channel bandwidth combination sets.Observation 1-4: Power class 2 should be the default power class. Support power boosting (beyond the nominal PC class) for low-PAPR waveforms from initial 6G release as native feature.Observation 1-5: NR MPR concept with inner and outer is quite good although the table listing MPR values gives excessive reduction especially for CP-OFDM. Further work on maximizing output power is deemed necessary for 6G. A-MPR concept is largely inherited from 4G and is not good anymore. It is too complex and still do not maximize the output power, so the A-MPR concept must be enhanced.Observation 1-6: Very complex in LTE and NR partly because new features/functionalities are added afterwards which breaks the fluent structure of the clause. Improvement needed.Observation 1-7: Important for modulator impairments. Improvement over NR is necessary, similarly as from LTE to NR.Observation 1-8: Spectrum emission mask is needed for regulator purposes and ACLR is needed for co-existence. UTRA ACLR should not be defined anymore.Observation 1-9: This can be seen as a package. From specification simplicity and UE performance point of view dRib should be avoided. If dRib is not defined then there is less pressure to tighten the baseline REFSENS. If dRib is allowed, then big improvement to LTE/NR REFSENS must happen.Observation 1-10: Discussion should happen if In-band blocking, out-of-band blocking, narrow band blocking and spurious response clauses can be combined into one clause in 6G. Observation 2: NR carrier aggregation and dual connectivity requirements are defined in same specifications as single band requirements i.e. 38.101-1 and 38.101-2. This is good arrangement as carrier aggregation clauses refer often to single carrier requirement clauses and dual connectivity clauses refers to carrier aggregation requirement clauses.Observation 2-1: Operating bands for CA is a useful tool to have as conditions or restrictions can be added for a band combination level instead of CA configuration level.Observation 2-2: CA bandwidth classes: would be good if simpler solution is established for capturing requirements for individual CA configurations.Observation 2-3: In 6G no BCSs should be defined, instead UE (minimum/maximum bandwidth) capabilities are signalled to the network.Observation 2-4: Similarly, as for single band operation PC2 should be the baseline per band. No artificial band combination power classes should be introduced, instead power classes apply per band and can be used to the maximum given that SAR is met.Observation 2-5: MPR/A-MPR/Pcmax/dTib: What was written for single band operation hold also here with an emphasis that MPR and A-MPR needs to be defined better in order not to restrict output power unnecessarily.Observation 2-6: REFSENS and dRib can be seen as a package. From specification simplicity and UE performance point of view dRib should be avoided. If dRib is not defined, then there is less pressure to tighten the baseline REFSENS. If dRib is allowed, then big improvement compared to LTE/NR REFSENS must happen.Observation 2-7: Defining MSD is complicated and time consuming. It has also a price tag which is not small as a lot of effort is put into defining MSD number which needs also to be tested. This MSD number is based usually on an allocation that produces worst-case MSD. These allocations are for example 1RB+1RB which are not used in real deployments. For all other allocations UEs perform better than defined MSD, note that also for allocation that is exactly defined for MSD test case UEs will typically perform much better than the requirement. We do not see any value on having this number in the specifications.Observation 2-8: Power imbalance for CA from non-collocated requirements for some overlapping bands combinations should be defined from the beginning so that confusing signalling extensions can be avoided.Observation 3: We know for a fact that number of NR SA and NSA combinations are counted in tens of thousands at the time of writing. If RAN4 would need to combine all those with new 6G bands that would multiply number of combinations into hundreds of thousands. Not even the ongoing effort for database solution would save RAN4 from stagnation. In our opinion no NSA RAN4 requirements are needed for 6G. Current NR requirements including EN-DC apply for NR in case of NSA with 6G and 6G SA requirements would be specified but no NR+6G requirements such as MSD, BCS, dTib, dRib etc are defined. |
| [**R4-2409511**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409511.zip) | Considerations on specification structure enhancements | ZTE Corporation, Sanechips | Observation 1 In current spec, the structure is organized by the requirements with different features packing into the second level sub-clauses. However, there are also some second level features further recursively categorized into third level features. This makes the spec more complicated to handle and the readability is poor.Proposal 1 For the structure of current RF specification, 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.­ Considering the workload and the stability of the specification, the optimization of the specification structure could be started after Rel-19. |
| R4-2407226 | Removing MSD Tables | Apple | widthdrawn |

## Sub-topic 3-1 Larger spec structure improvements

*Background*

From R4-2406709

**Option 1**: the framework used in current 4G and 5G spec. (i.e. The same requirements for different features are packed in the second sub-clause together.)

**Option 2**: All of (additional) requirements for each feature could be packed together.

*Open issues and candidate options before meeting:*

**Issue 3-1-1: Larger structure changes**

* Proposals
	+ **(R4-2407544, CATT) Proposal:** RAN4 to consider the following modified suffix-based approach as a larger specs structure enhancement for UE RF specs:
		- 5 Operating bands and channel arrangement
		- 5A Operating bands and channel arrangement for CA
		- 6 Transmitter characteristics
		- 6A Transmitter characteristics for CA
	+ **(R4-2407690, Huawei) Proposal 1:** Do not adopt Option 2 for the existing specifications.
	+ **(R4-2407987, LG Electronics) Proposal 1**: Consider Option 3 as specification structure enhancement.
		- Option 3: Reorderding all of requirements for each feature could be packed together.
	+ **(R4-2408073, SAMSUNG) Proposal 1**: RAN4 shall avoid to have big specification structure change for NR specifications at this late stage.
	+ **(R4-2408073, SAMSUNG) Proposal 3:** For 6G preparation, RAN4 shall further study new framework/specification structure for the introduction of new bands/frequency ranges, CA/DC, and or new power classes.
	+ **(R4-2409511, ZTE Corporation) Proposal 1**: For the structure of current RF specification, 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.
		- Considering the workload and the stability of the specification, the optimization of the specification structure could be started after Rel-19.
* **Recommended WF**
	+ **(R4-2408073, SAMSUNG) Proposal 1**: RAN4 shall avoid to have big specification structure change for NR specifications at this late stage.
* **Issue 3-1-2: Future looking specification structure proposals**
	+ **(R4-2407690, Huawei) Proposal 2**: Keep both Option 1 and Option 2 as candidate in case RAN4 discusses specification structures for new specifications, e.g., 6G.
	+ **(R4-2408073, SAMSUNG) Proposal 2**: Considering diverse and uncertainty of different WIs/features and accumulated sections with new WIs/features, not treating WIs/Features as a generic item to divide sections. WIs/features can be treated case by case when corresponding requirements introduced.
	+ **(R4-2408073, SAMSUNG) Proposal 4:** Introduce UE RF sub-specifications or main chapters based on test methodologies (similar as UE demodulation specification TS 38.101-4 and BS specification TS 38.104):
		- Conductive Tx/Rx characteristics / TS xx.xxx-1 Conductive UE RF requirements
		- Radiated Tx/Rx characteristics/TS xx.xxx-2 Radiated UE RF requirements
		- Requirements for interworking/TS xx.xxx-3 UE RF requirements for inter-working
	+ **(R4-2407544, CATT) Proposal (moderator note, proponent intended this for 5G specs but adopted also here for next gen) :** RAN4 to consider the following modified suffix-based approach as a larger specs structure enhancement for UE RF specs:
		- 5 Operating bands and channel arrangement
		- 5A Operating bands and channel arrangement for CA
		- 6 Transmitter characteristics
		- 6A Transmitter characteristics for CA
* **Recommneded WF:**
	+ Discuss views, maybe agree **(R4-2407690, Huawei) Proposal 2**: Keep both Option 1 and Option 2 as candidate in case RAN4 discusses specification structures for new specifications, e.g., 6G.