**3GPP TSG-RAN WG4 Meeting # 99-e R4-210XXXX**

**Electronic Meeting, 19th – 28th May, 2021**

**Agenda item:** 4.1.2

**Source:** Hisashi Onozawa (Nokia)

**Title:** Email discussion summary for [99-e][102] NR\_NewRAT\_UE\_RF\_R15

**Document for:** Information

# Introduction

Rel-15 UE RF requirement maintenance is discussed in this thread.

* Topic #1: RAN5 LS reply
	+ Sub-topic 1-1: Ambiguity in deciding TL,C
* Topic #2: CA/DC NS
* Topic #3: Maintenance of TS 38.101-1 and TS 38.307
	+ Sub-topic 3-1 FR1 UL MIMO EVM
	+ Maintenance CRs to TS 38.101-1
	+ Maintenance CRs to TS 38.307
* Topic #4: TS 38.101-2 maintenance
	+ Sub-topic 4-1: EESS protection
	+ Sub-topic 4-2: RF requirement applicability under ETC (FR2)
	+ Maintenance CRs to TS 38.101-2
* Topic #5: intra/inter-band Contiguous/Non-Contiguous MRDC
* Topic #6: TS 38.101-3 maintenance
	+ Sub-topic 6-1: CIM
	+ Maintenance CRs to TS 38.101-3

Agenda changes:

R4-2110982 🡨 AI 5.1.7.2 [#103]

R4-2111353 🡨 AI5.3 [#105]

R4-2110186/0187/0188/0189/0190/0191 🡪 5.1.7.2 [103]

R4-2110805 🡪 13.2 [#159]

R4-2110806, R4-2110396 🡪 13.2 [#160]

R4-2110932/0933/0934 🡪 13.2 [#134]

# Topic #1: RAN5 LS reply

LS reply to the following LS from RAN5 is handled in Topic#1.

* R4-2100020 (R5-206676) LS on ambiguity in deciding TL,C

## Companies’ contributions summary

LS reply

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2108926**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108926.zip) | Nokia, Nokia Shanghai Bell | LS to RAN5 that confirms that ∆Tc should not be double counted and fix errors by removing ∆TC,c from relevant PCMAX\_L,f,c formulas such asPCMAX\_L,f,c = MIN {PEMAX,c– ∆TC,c, (PPowerClass – ΔPPowerClass) – MAX(MAX(MPRc+∆MPRc, A-MPRc)+ ΔTIB,c + ∆TC,c +∆TRxSRS, P-MPRc) } |
| [**R4-2108927**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108927.zip) | Nokia, Nokia Shanghai Bell | CR related to the above paper.dTc is removed from relevant PCMAX\_L,f,c formulas. |
| [**R4-2110389**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110389.zip) | Huawei, HiSilicon | Proposal 1: The understanding 1 “The source of ∆TC,c  is the same as NOTE 3 in table 6.2.1-1, therefore the 1.5dB relaxation shouldn’t be considered again when deciding TL,C” is correct.Proposal 2: It is not expected to change the current requirements for lower limits of PUMAX,f,c and RAN4 can implement the corrections as option 1 to clarify it. |
| [**R4-2110421**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110421.zip) | Huawei, HiSilicon | CR for the above paper.Clarifying that tolerance TL,c doesn’t consider 1.5dB relaxation when deciding lower limit of Pumax. |
| [**R4-2110436**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110436.zip) | ZTE Corporation | The 1.5dB relaxation shouldn’t be considered again when deciding TL,C. i.e. Understanding #1 is the correct understanding. |

## Open issues summary

### Sub-topic 1-1 Ambiguity in deciding TL,C

All contributions confirm that 1.5 dB relaxations shall not be counted twice as RAN5 pointed out. There are two draft CRs and three LS reply drafts available.

**Issue 1-1: Ambiguity in deciding TL,C**

* Proposals
	+ Option 1: dTc is removed from relevant PCMAX\_L,f,c formulas. (Nokia)
	+ Option 2: Clarifying that tolerance TL,c doesn’t consider 1.5dB relaxation when deciding T(PCMAX,f,c) (Huawei)
	+ Option 3: A simple clarification to TS 38.101-1 by adding text “excluding ΔTC,c” (ZTE)
* Recommended WF
	+ Agree either one of the above options; agree CR and LS drafts together.

## Companies views’ collection for 1st round

### Open issues

Sub topic 1-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Option 1Option 1 looks more reasonable as 1.5dB is to account for further filter insertion loss which should be added outside the PCMAX equation. |
| DOCOMO | Option 1We think option 1 is better aligned with the original motivation of 1.5dB relaxation for maximum output power. For option 2, 1.5dB relaxation also applies to the case Pcmax is lower than maximum output power. |
| ZTE | We think the common understanding among companies is that the delta Tc should not be double calculated. But we prefer to keep the delta Tc parameters in the equation.  |
| OPPO | Both options are doable, more prefer Option2, and in our view the changes to Pcmax calculation itself should keep unchanged to accommodate Rel-15 UEs, and the tolerance can be modified which is testing issue. |
| Ericsson  | Option 1 |
| Huawei | Option 2, Based on our analysis, both option 1 and option 3 can change current requirements which is specified from Rel-15. |
| Nokia | Maybe I should not comment that I prefer my option, but I do 😊 |

### CRs/TPs comments collection

*For close-to-finalize WIs and maintenance work, comments collections can be arranged for TPs and CRs. For ongoing WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

# Topic #2: CA/DC NS

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

## Companies’ contributions summary

Here’s the list of contributions on CA/DC NS issues for TS 38.101-1.

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2109140**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109140.zip) | SoftBank Corp. | A sentence is added on requirement when an NS is indicated in a band, according to WF(R4-2103120). |
| [**R4-2109143**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109143.zip) | SoftBank Corp. | Rel-16 change of the above CR.Cat A CR to Rel-17 (R4-2109145) |
| [**R4-2109153**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109153.zip) | SoftBank Corp. | **[Proposal-1] As a baseline, it is proposed to confirm the current assumption that -50dBm/MHz can be met.****[Proposal-2] For exceptional cases, we should firstly agree a practical scope, which cases we need to address and which cases not.****[Proposal-3] If the group wants to continue this initiative, I’d like to ask a UE/chipset vendor delegate to take a lead with sufficient insight.** |
| [**R4-2109437**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109437.zip) | Apple | **Proposal 1:** Consider UL RB restrictions and A-MPR for b20 if NS\_43 is signalled for DC\_20-n8, CA\_n8-n20 and CA\_8\_20.**Proposal 2:** Consider the introduction of A-MPR for b20 if NS\_28 or NS\_31 is signalled for CA\_26-36.**Proposal 3:** Consider the introduction of UL RB restrictions or the definition of A-MPR for n71 if NS\_18 is signalled for CA\_n28-n71. In case of NS\_17 no transmission in n71 can take place.**Proposal 4:** Consider the introduction of UL RB restrictions or the definition of A-MPR for n39 if NS\_50 is signalled for CA\_n3-n39.**Proposal 5:** Consider the introduction of A-MPR for the second UL covering all CA/DC combinations if NS\_04 or NS\_27 or NS\_43(LTE) are signalled. **Proposal 6:** Consider the introduction of A-MPR and UL restrictions for n77 and n78 combinations if NS\_22(LTE) or NS\_23(LTE) is signalled for DC\_42-n77 and DC\_42-n78.**Proposal 7:** Discuss the harmonic issues for all CA/DC combinations (provided in table 1) case by case and consider the introduction of A-MPR or exceptions for the second UL.**Proposal 8:** Continue to discuss individual solutions for troubling CA/DC combinations. **Proposal 9:** It should be required that with each new CA/DC combination NS requirements are checked for potential issues. |
| [**R4-2110288**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110288.zip) | Huawei, HiSilicon | **Observation 1: Currently, the NS values** ***additionalSpectrumEmission* have been specified in a band specific manner for NR instead of UL CA/DC.****Observation 2: If the additional requirements for UL CA/DC will be introduced into specification, the additional requirements for UL CA/DC may not be tested for current field UEs.****Observation 3: Additional emission requirements used for band A NS\_XX may not be applied for the UL band combination CA\_A-B.****Proposal 1: It’s recommended to introduce additional emissions requirements for UL CA/DC one by one based on the operators’ request.****Proposal 2: It isn’t appropriate to introduce the additional requirements for UL CA/DC in Rel-15 TEI.** |
| [**R4-2110984**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110984.zip) | Qualcomm Incorporated | **Proposal: Revert the agreement from [2] (R4-2103120). NS emission requirements only apply for the band in which they are signaled.** |

Here’s the list of contributions on CA/DC NS issues for TS 38.101-3.

|  |  |  |
| --- | --- | --- |
| [**R4-2109146**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109146.zip) | SoftBank Corp. | A sentence is added on requirement when an NS is indicated in a band, according to the WF(R4-2103120)Cat A CR to Rel-16 R4-2109148 |
| [**R4-2109149**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109149.zip) | SoftBank Corp. | Rel-17 CR for the above CR. |

## Open issues summary

### Sub-topic 2-1 CA/DC NS

**Issue 2-1: CA/DC NS applicability**

* Proposals
	+ Option 1: Single band NS is applicable to CA/DC according to agreed WF (Softbank); agree CRs to 38.101-1 and 38.101-3.
	+ Option 2: Revert the agreed WF (Qualcomm)
	+ Option 3: Introduce additional emissions requirements for UL CA/DC one by one based on the operators’ request. (Huawei)
	+ Option 4: Continue to discuss individual solutions for troubling CA/DC combinations. It should be required that with each new CA/DC combination NS requirements are checked for potential issues. (Apple)
* Recommended WF
	+ Collect views in 1st round and allocate a WF for the 2nd round.

**Issue 2-2: List of problematic NS**

* Softbank proposes that -50dBm/MHz can be met as a baseline and exceptional cases need to be identified. Problematic NS in CA/DC is analyzed by Apple as proposed below.
	+ Proposal 1: Consider UL RB restrictions and A-MPR for b20 if NS\_43 is signalled for DC\_20-n8, CA\_n8-n20 and CA\_8\_20.
	+ Proposal 2: Consider the introduction of A-MPR for b20 if NS\_28 or NS\_31 is signalled for CA\_26-36.
	+ Proposal 3: Consider the introduction of UL RB restrictions or the definition of A-MPR for n71 if NS\_18 is signalled for CA\_n28-n71. In case of NS\_17 no transmission in n71 can take place.
	+ Proposal 4: Consider the introduction of UL RB restrictions or the definition of A-MPR for n39 if NS\_50 is signalled for CA\_n3-n39.
	+ Proposal 5: Consider the introduction of A-MPR for the second UL covering all CA/DC combinations if NS\_04 or NS\_27 or NS\_43(LTE) are signalled.
	+ Proposal 6: Consider the introduction of A-MPR and UL restrictions for n77 and n78 combinations if NS\_22(LTE) or NS\_23(LTE) is signalled for DC\_42-n77 and DC\_42-n78.
	+ Proposal 7: Discuss the harmonic issues for all CA/DC combinations (provided in table 1) case by case and consider the introduction of A-MPR or exceptions for the second UL.
* Recommended WF
	+ Moderator suggests further study the above cases in general. In particular,
		- Moderator suggests companies to comment if -50 dBm/MHz limit can be met in general and also comment in what conditions the emissions may violate the limit.
		- Moderator suggests companies to comment if the above analysis by Apple is correct/incorrect, or more study is needed, etc.

## Companies views’ collection for 1st round

### Open issues

Sub topic 2-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Our contribution reveals that there exist several potential issues which have to be addressed. As the discussion is still evolving and there is no general strategy on how to handle those cases yet, we think it is too early to agree on the CRs proposed by Softbank. The agreement (made in the last WF) might need considerable changes depending according to the solutions taken for the troubling CA/DC cases. Our viewpoint is that the adjustments in emission handling and the solutions need to be agreed as a package and not as individual changes. |
| SoftBank | Sorry for lengthy comments first of all,Option 1 is about how to capture a general rule and we also expect exceptions to the rule raised in ex. Option 4 by Apple. These are in line with the WF in the previous meeting(3120). Option 2 seems to interpret as if option 1 is the only requirement imposed to any CA/DC, but it is not our intention. I hope the comment above clarifies the situation.To Apple: For the comment above, please consider our comment on Option 3. Further postponing would increase serious risk as mentioned in Huawei’s contribution, i.e. looking like unspecified. Or would you give us a solution for the situation?For Option 3, I’d like to get a feedback on the content of the contribution firstly.The relevant contribution said as below:“As discussed under the paper R4-2014307 in the first round from email summary paper [3], companies provided some important information that UL CA\_1-8 should not have PHS protection in the general CA/DC table while CA\_3-8 should do. It means that the additional emission requirements may not always be applied for UL CA\_A-B, even if the additional emission requirements are applicable for one band in this combinations. For instance, NS\_05 for PHS protection is applied for band 1, but PHS protection using NS\_05 is not applied for CA\_1-8”I’d like to explain why this happens:1) CA 1-8 for PHS protection had been in general UE co-ex table, at least by Mar 20 version, with a note ”applied with NS\_05”.2) When we cleaned up UE co-ex table in May‘20 with the same fashion, i.e. putting the additional requirement in the general co-ex table with a note (applied with NS\_XX), they were a few comments from vendors, including Huawei, that capturing an additional requiremernt in the general table was not likely then we had to delete it. (You can check the situation in R4-2008292, first round summary)3) The proposal from me this time is a continuation of to how to capture the additional requirement which was there but requested to be deleted in May last year.So I am quite puzzled by the contribution from the standpoint of consistency of comments made by the same company. While I understand that vendor people are so busy, as a minimum, I’d sincerely ask delegates to check/consider what the colleagues said before. For Japan-related CA/DC with NS, then it seems tests should be done at least before Jun 20 version because they were there. Is it correct? |
| OPPO | Option 2/3/4 are ok to us but preferred Option 3, and if extending NS to band combinations, then it should be analyzed one by one and make sure that no problems are there. With the problems identified in the band combinations, it seems simply requiring UEs to follow the single band NS is not proper and need to further discuss how to handle the NS in CA/DC band combinations, e.g. making the NS apply to band combinations as baseline principle and find out the exception combinations, or making the NS only apply to band combinations requested by operators one by one and checking the problem. Comparing the two approaches, the latter one is preferred in work handling from workload perspective. |
| Ericsson | The NS values indicates additional unwanted emissions requirements and only apply in the bands in which they are indicated (i.e. in which the emissions requirement applies). If the requirement is regulatory it has to be met for all UE transmissions. |
| SoftBank-2 | Thanks for the comments. It seems that, so far, basic views on the issue are largely aligned such as “baseline principle and exception” in OPPO’s comment but there is a discrepancy on how or when to capture the issues in 101.We still prefer to go with Option-1 with allowing exception to be added later ( “unless otherwise noted”) because of the problem we mentioned for Huawei’s contribution, i.e. regulatory requirements left uncovered for a while. It is apparent that regulatory enforcement takes precedence over 3GPP spec. anyway, so the current situation is not good for 3GPP spec..But if the group is not happy with our CR, as a minimum, we’d like to agree/capture what Ericsson commented as “baseline principle” (it is not easy to use “if the requirement comes from regulatory” in 101 context),Is there any suggestion? |
| Huawei | To Softbank, If I misunderstand your comments, I'm really sorry for that. I think the key issue is how to distinguish the general emission requirements and additional emission requirements. For UL CA\_n1-n8, if we add PHS protection into the general coexistence table, UE may have to meet these additional requirements PHS protection using MPR when NS\_01 is indicated in band n1. I think it's also not your intention. But for UL CA\_n3-n8, even NS\_01 is indicated in both band n3 and n8, the PHS protection can be met by UE using MPR. Thus, the PHS protection can be added into general co-ex table for UL CA\_n3-n8.In order to make progress, we recommend to create a new clause to clarify the additional requirements for UL NR CA as below for example. Maybe wording and format can be improved.6.5A.3.3 Additional spurious emissions for UL NR CA

|  |  |
| --- | --- |
| NR CA combination | Spurious emission |
| Protected Band | Frequency range (MHz) | Maximum Level (dBm) | MBW (MHz) | Signlling |
| CA\_n1-n8 | Frequency range | 1884.5  | -  | 1915.7  | -41 | 0.3 | NS\_05 indicated for band n1 |

We can clearly specify the Additional spurious emissions for UL NR CA one by one instead of using general statement. |
| DOCOMO | Option 1If an NS value is indicated in a band, the additional requirement shall be met regardless if the UE has uplinks configured in the other bands, as agreed in the related WF. We expect that UE meets additional requirements in the same way as before since some additional requirements associated with NSs were specified in UEtoUE coexistence in the previous version of the specification. |
| SoftBank-3 | I should note that Qualcomm’s comment (support Option 2, to object a general way to capture the requirements) is skipped due to thread forking at v23. Taking opinions so far into consideration, how about:1. To make clear the additional UE co-ex requirements for CA/DC, follow huawei’s proposal to create a new table, probably in 6.5.XXX of 38.101-1 or equivalent section.

This was proposed once before but I hope agreeable this time. We do not like to go round one more time. |

Sub topic 2-2

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| --- | --- |
| **Company** | **Comments** |
| Apple | After RAN4#98-e we did an exhaustive investigation to find potential cases which could violate NS requirements. The findings presented in the contribution can be split into two categories. The first one covers all cases where NS requirements (signaled for the first UL) overlap with or are in near proximity with the second UL. In those cases we think that additional power backoff and UL RB restrictions could be a solution to comply with the emission limits.The second category includes all cases where harmonics are located inside the NS requirements. The spurious emission tables for UE co-existence (e.g. 38.101-1 Clause 6.5.3.2) have exceptions for harmonics falling into protected regions. The exception allows emission levels up to the general spurious emission limits (please see note 2 in e.g. 38.101-1 Clause 6.5.3.2 for further details). This shows that the harmonics of a UE are generally not expected to do much better than those limits. This is the reason why we conducted a search on all CA/DC combinations to find the cases where harmonics can fall into NS protected regions. We do not claim that all listed cases are an issue (some are certainly not) but wanted to provide a full list for completeness and to be able to add more combinations which might have been overlooked. |
| SoftBank | For proposal-1, since NS\_43 in NR is for the protection of Band 18/19 range in Japan, this is not relevant to Region 1 where B20 is used. We do not have to worry about it.For proposal-6, I guess this is for cases where B42 and B43 is not synchronized. We need to check if the assumption is still meaningful : B43 is left unused in LTE and integrated into n77/n78 in NR.Foe the comment from Apple above: as written in 9153, we have assumed 2UL IMD does not violate -50dBm/MHz then the relevant evaluation has not been conducted. Also written in 9153, I cannot judge if there is a problem or not. Will you take a lead for studying this issue further?  |
| OPPO | The combinations can be used as starting point to study whether special handling is needed like new NS for the band combinations etc. For the IMD, it seems not been considered as the exceptions in the UE coexistence requirements, it might means that 2UL IMD doesn’t violate -50dBm/MHz, but need further study and confirmation. |
| DOCOMO | Thank you for the contribution.Regarding proposal 6, UL\_DC\_42\_n77 and UL\_DC\_42\_n78, and DC\_43\_n77 and DC\_43\_n78 have not yet specified, so we don’t have to consider the case mentioned in proposal 6.Regarding proposal 7, for DC\_21\_n28(CA\_21-n28) and CA\_n28\_n74, we wonder if this is really problematic cases since the protection requirements is -35dBm/MHz while UE shall meet general spurious of -30dBm/MHz Furthermore, for DC\_21\_n28, the UL frequency range in band n28 is restricted for the band combination as 728 - 738 MHz as described in NOTE 17 in Table 5.5B.4.1-1 in TS 38.101-3. So we don’t think this is not a problematic case. |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

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

# Topic #3: Maintenance of TS 38.101-1 and TS 38.307

## Companies’ contributions summary

Contributions related to UL MIMO EVM issues are listed.

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2108818**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108818.zip) | Qualcomm Incorporated, Lenovo, Motorola Mobility | **Proposal 1: For 2L UL, EVM and EVM equalizer spectrum flatness shall be evaluated per layer regardless of diagonalization method chosen by RAN4.** **Proposal 2: The reference receiver for the 2L UL MIMO EVM test case for slot length signals shall simultaneously measure the UE’s UL at both antenna connectors and implement a 2x2 LSE-based zero-forcing equalizer to diagonalize the channel.****Proposal 3: The minimum number of OFDM symbols to apply a 2x2 LSE-based zero-forcing equalizer is FFS.** **Observation 1: Legacy UEs that meet the old 2L EVM requirement will also meet the new requirement with the new TE method.** **Observation 2: Legacy TE built to the old 2L EVM requirement can cause false failures of compliant UEs.**  |
| [**R4-2108815**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108815.zip) | Qualcomm Incorporated, Lenovo, Motorola Mobility | **CR for the above discussion paper.** |
| [**R4-2109914**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109914.zip) | Rohde & Schwarz | **Proposal 1:** RAN4 agrees on the presented approach for FR1 UL MIMO transmit signal quality. The proposed dual receiver methodology in our view applies to the following:* Error Vector Magnitude (EVM) for the allocated resource blocks (RBs)
* EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process
* Carrier leakage (caused by IQ offset)

**Proposal 2:** RAN4 further discusses the applicability of the approach to TxD once an agreement for UL MIMO has been achieved. |

Maintenance CRs (and companion discussion papers) to TS 38.101-1 are listed.

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2109379**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109379.zip) | Qualcomm Incorporated | Observation 1: There are some frequency bands that use a split duplexer implementation due to narrow duplex gap. In that case UE may not support non-default TX-RX channel frequency separations**Proposal 1: A note should be placed in table 5.4.4-1 stating: Bands n28 and n74 UE may only support the default TX-RX frequency separation values.** |
| [**R4-2108790**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108790.zip) | Qualcomm Incorporated | CR for the above discussion paper.Add note in table 5.4.4-1 for bands n28 and n74 to state that only the default TX-RX frequency separation values are supported |
| [**R4-2108869**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108869.zip) | Rohde & Schwarz | Merged tables for 15, 30 and 60 kHz SCS, TDD and FDD into a single tables.Removed redundant information.Removed tables for 30 and 60 kHz SCS.Removed TDD tables.Added new table for TDD active uplink slots.Updated references to Annex A.2. |
| [**R4-2108977**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108977.zip) | Dish Network | Modifying asymmetric UL/DL configurations to fix CR R4-2101992 implementation |
| [**R4-2109166**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109166.zip) | NTT DOCOMO, INC. | Based on the R4-2103134 agreed in RAN4#98-e, the following requirements will be added.1. Co-existence requirements from n40 to Japan bands and PHS.
2. Co-existence requirements from Japan bands to B40. This change is only seen in CAT-A CR.
3. Co-existence requirements for CA to be modified according to the above changes. This change is only seen in CAT-A CR.

However, co-existence requirements between n40 and n41 are currently under discussion in RAN4, so they are not included in this CR. |
| [**R4-2109453**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109453.zip) | Apple | 1. Band 12: Harmonic exceptions for band 48 has been missed. Removed harmonic exception from band 70 as it is not affected by any harmonic.2. n28, n83: Harmonic exceptions are added for band 11 and 21 as they can both be affected by second harmonic. |
| [**R4-2111367**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111367.zip) | Huawei, HiSilicon | Add a note to clarify the tolerance is referring to close loop power control. |

CRs to TS 38.307 are listed.

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2110424**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110424.zip) | Huawei, HiSilicon | Delete the column “duplex mode” for band combinations |
| [**R4-2110448**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110448.zip) | ZTE Corporation | By using the similar method of TS36.307, the NOTE for each ‘duplex-mode’ in the table is added. Also duplex mode of ‘SDL and FDD’ and ‘FDD and TDD’ are added for PC3 inter-band NR CA and ENDC, respectively. |

## Open issues summary

Please comment to CR drafts directly in 3.3.2, other than the sub-topic 3-1.

### Sub-topic 3-1 UL MIMO EVM

**Issue 3-1: UL MIMO EVM**

* Proposals
	+ Option 1: EVM and EVM equalizer spectrum flatness shall be evaluated per layer based on R4-2108818. (Qualcomm, Lenovo, Motorola)
	+ Option 2: FR1 UL MIMO transmit signal quality is measured per layer based on R4-2109914 (R&S)
* Recommended WF
	+ Collect comments in the first round.

## Companies views’ collection for 1st round

### Open issues

Sub topic 3-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| OPPO | Ok with per layer measurement, but we would like to confirm whether all the Rel-15 TEs can support this per layer measurement? |
| Rohde & Schwarz | In general we are ok with per layer measurement, in our proposal we also include Carrier leakage, but we can further discuss on this.From our point of view we should go with Option 2. The only concern by other companies against using Option 2 was that this may cause higher EVM due to only using DMRS for channel estimation. However in the mean time we were able to perform some actual EVM measurements comparing a traditional single layer measurement and 2 layer EVM measurements using the algorithm from Option 2.Green shows the EVM measurement for a single layer transmission using the current EVM measurement algorithm from the spec.Red shows the R&S proposed algorithm using 3 DMRS symbols for channel estimation for a two layer transmission.Blue shows the R&S proposed algorithm using 1 DMRS symbol for a two layer transmission.The graphs show the EVM for increasing AWGN levels, meaning the increase in EVM measured is due to the reduction in SNR.As can be seen from the curves the difference between the single layer and 3 DMRS symbol measurement is negligible.Since currently the UL RMCs are defined with 3 DMRS symbols and the graph shows no increase in the measured EVM, we cannot see any negative impact on the EVM measurement results using this method.Given that now two TE vendors are in favor of Alt 2-2-1-1, the method is easier to implement, avoids the issue of non-invertible matrizes and also has no significant impact on the EVM results, we should go with Option 2.Similar discussion is currently also happening for FR2 in the testability SI.  |
| Anritsu | Our preference is Option 2. But this should be discussed together with the corresponding subject in topic group 336. |
| Ericsson | We agree with the per-layer measurements and assume this also applies in Rel-16 for the FP verification. |
| Huawei | Firstly, here we discussing FR1 UL measurement is equipped with cable between TE and UE, we wonder here what is difference between antenna port and layer here? Crosstalk and leakage from PCB isolation is totally implementation issue that is not expected. So The CR R4-2108815 is not needed from requirement perspective.Secondly, from measurement perspective, the key difference between Option 1 and option 2 is symbol number that is used for channel estimation. For FR1 RF test, considering cable is connected between UE and TE, we don’t see much EVM measurement accuracy problem from channel estimation here, the connector and layer is almost aligned, the matrix is diagonal now!!In summary, we don’t think there is a necessary to revise both the requirement and measurement diagram, the TE implementation should not be touched by the spec. |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| [**R4-2109379**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109379.zip)[**R4-2108790**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108790.zip) | Apple: We do not see the necessity for this CR. The non-default Tx-Rx separation happens when the UL and DL channel BWs are not symmetric. The range of Tx-Rx separation is determined by the delta between the UL and DL channel BWs, not how the duplexer is implemented.DOCOMO:Question for clarification from technical perspective is that we guess as long as UE transmit and receive in the frequency range covered by the same duplexer, the Tx-Rx separation can be set at the values other than default. Is this correct understanding?OPPO: It is understood that default TxRx separation is not supported by separate duplexers, but is there spec says the default is mandatory?Ericsson: not sure why this has to be added, for n28 and n74 requirements are only specified for the default TX-RX separation. Any asymmetric BW in these bands could be subject to ‘asymmetric BCS’.Huawei: Generally, the default TxRx separation can guarantee the minimum requirements. If we shorten the TxRx separation, REFSENS desens can be observed for FDD bands. That means UE can't meet the minimum requirements.Dual duplexer filters have been used since LTE period without problems. Dual duplexer filters is not the only implementation on band n28. Currently, full band filter in Rx has been used in commercial field. If we use "only", the specific channal raster is not considered. I think the wording "default" is very perfect. It may have an impact on network scheduling which have been deployed in the field. We can't accept this correction in Rel-15. |
| [**R4-2108869**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108869.zip) |  |
| [**R4-2108977**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108977.zip) |  |
| [**R4-2109166**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109166.zip) | Apple:The CAT A CR as mentioned in this CR should be CAT F CRs as the CR contents are expected to be different from this CR. They should be reviewed together with this CR before the agreement.Docomo: Thank you for your comments.In our understanding, it is no problem if the core of the changes is based on the oldest release (CAT-F CR) for all other releases (CAT-A CR). We think it is common understanding that later releases changes may not be exactly same with the prior release(s). And the delta between Cat A CR and Cat F CR are mentioned in "Summary of change" in CAT-F CR and R4-2103134 agreed in RAN4#98-e. We confirmed it with Technical Officer of ETSI (and RAN4 chairman) before the meeting.ZTE: Is it needed to correct the NR CA band combination constitute of band n40? |
| [**R4-2109453**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109453.zip) | Apple: Uploaded revision. The revision does not anymore add harmonic exceptions (i.e. note 2) for all cases where notes 24 and 25 (also granting harmonic exception) are present.Huawei: There is no need to add note 2 for band n28, since note 24 has consider the 2nd harmonic exceptions. |
| [**R4-2111367**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111367.zip) | Apple:There is no “close loop power control” defined in RAN4 specifications. The requirements related to close-loop power control are referred to “relative power tolerance”. However, we do not see how the power class tolerance is related to the “relative power tolerance”. Therefore, this note is not needed.OPPO: Agree with apple, not see why this is needed.Ericsson: not agreed, the tolerances always apply at the maximum output power setting.Huawei, HiSilicon:To Apple, if power class is referred to open loop power control, then +-9dB power tolerance would be applied. But +-2 dB power tolerance is obviously not from open-loop, it is measured by relative power boost procedure, so we would like to clarify it is from close-loop power control.Close-loop is terminology used in TS 38.213, we think it is natural to align RAN4 spec to RAN1.Nokia: what is the reason that we need this note now and it has not been needed before for example in LTE. MOP is regulatory requirements which UE needs to meet without NW assistance. |
| [**R4-2110424**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110424.zip) | DOCOMO:We prefer to delete “duplex mode” from TS 38.307 according to R4-2110424 if no issues are identified. We wonder if “duplex mode” information is useful while it may require some workload to update it as latest condition.ZTE: We think the duplex mode is useful information for band combination release independence due to there are no release independence information in the WID. Actually the duplex modes for the band combination in each release 38.307 spec are aligned with the each release 38.101 specs, i.e. the combinations in Rel-15 101-1 spec are reflected in Rel-15 38.307, the combinations in Rel-16 101-1 spec are reflected in Rel-16 38.307. If lost the duplexer information for these combination, it may lead some confusions. For example: In Rel-15 38.101-1, only duplex-mode of TDD intra-band contiguous CA combinations are supported, however if we delete the duplex-mode, then it will change the meaning that FDD intra-band contiguous CA combinations are also supported in Rel-15, but it is not true. Another example is for inter-band NR CA, only TDD for both band and TDD-FDD are supported for UL in Rel-15 101-1 spec, however if we delete the duplex-mode, then it will change the meaning that FDD-FDD are supported for UL in Rel-15, also it is not true. OPPO: No strong view, change of this CR is contradicting with 448.Huawei: To ZTE, you misunderstand this meaning in the table. Both TDD and FDD intra-band NR CA combinations can be release independent from Rel-15, no matter this kind of band combinations are introduced in Rel-15 or Rel-16. Release independent method is only restricted by RAN2's signaling in different release. For FDD-FDD UL CA, we can't understand why this kind of band combination can't be supported from Rel-15, even if this kind of band combinations are specified in Rel-16 spec. There is no signaling restriction. If companies have another understanding on this duplex column, it's necessary to delete them for clarification. We don't need to use this column indicate which kind of band combinations are specified in current spec. All the duplex information can be found in 38.101-1, Anyway, 38.307 should be aligned with 38.101-1. There are so many misalignment on the duplex information, but companies still want to keep them.In order to make progress, we can compromise to keep the duplex information for intra-band CA / DC /ENDC, which is aligned with RAN2 TDD/FDD diff.Nokia: In LTE we have a case that FDD+TDD CA is R12 where FDD or TDD CA is R10, how capture this kind of info in future if needed |
| [**R4-2110448**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110448.zip) | DOCOMO: We prefer to delete “duplex mode” from TS 38.307 according to R4-2110424 if no issues are identified. We wonder if “duplex mode” information is useful while it may require some workload to update it as latest condition.ZTE: Reply to DoCoMo, see aboveOPPO: No strong view, change of this CR is contradicting with 424.Nokia: If it decided that this information is needed then it could be placed in Clause 4. Then we do not need to repeat same text in many tables |

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

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

# Topic #4: TS 38.101-2 maintenance

## Companies’ contributions summary

Contributions related to EESS protection (WRC-19) is listed in the following.

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2110808**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110808.zip) | OPPO | ***Observation 1: Introducing now or in the future is the main difference for 2024/2027 requirements.******Observation 2: Introduction of NS\_203 has set a good example on how to introduce requirement for the near future.******Observation 3: Possibility of forgetting these 2024/2027 requirements in RAN4 is low.******Observation 4: Without being required by regulatory bodies, the meaning of introducing future requirements is low.******Observation 5: Comparing introducing now, postpone defining the 2024/2027 requirements will have less impact to RAN4/RAN5/GCF and also the industry.******Proposal 1: Postpone defining the 2024/2027 requirements, NS\_203 approach can be used as reference in future.*** |
| [**R4-2111509**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111509.zip) | NTT DOCOMO INC. | **Proposal 1: Update each option as option 1-a and 2-a, and clarify the following aspects:*** **For Option 1-a: Not introducing the requirements after 2024/2027 in the current spec, but RAN4 can further discuss them whenever it is necessary,**
	+ **An appropriate length of the period to make chipset, UE, NW, and TE compatible with new NS(s) should be investigated so that the UE can meet EESS protection and be tested for regulatory compliance after changeover date,**
	+ **How to implement mandatory support indication by modified MPR correctly in the specification around 2024/2027(Where to capture the previous agreements for future work).**
* **For Option 2-a: Introduce NS\_20Y (-5dBm/200MHz protection for n257/n258 applied after 2027) into standard now and use normative or informative notes like ‘applicable from <calendar date>’ to indicate the changeover dates (handling of NS\_20X is FFS),**
	+ **How to write the description of NOTE to address potential issues.**

**Proposal 2: Take option 2-a as baseline and focus on how to write the description of NOTE to address potential issues.** |

Contributions related to RF requirement under ETC is listed in the following.

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2109671**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109671.zip) | vivo | **Observation 1**: From testability perspective, the supporting of 3D scan with extreme temperature condition is confirmed. The impacts on test system under ETC condition is under discussion in FR2 enhanced test methods SI.**Observation 2**: The impacts on UE performance under ETC is related to the applicability or relaxation of core requirement, which is suggested to be discussed in Rel-15 FR2 RF TEI based on RAN4 leadership guidance.**Observation 3:** The following core requirements are Not applicable for extreme environmental testing conditions (i.e. defined based on normal conditions), i.e., *EIRP/EIS spherical coverage, Power control, EVM/EVM equalizer spectrum flatness, Beam correspondence*.**Observation 4:** Among the requirements in observation 3, the following requirements are only applicable (i.e. defined based on) for normal conditions, i.e., *Power control (Single carrier/CA),* *EVM/ EVM spectral flatness (Single carrier/CA/UL MIMO)*.**Observation 5:** EIRP/EIS spherical coverage (Single carrier/CA/UL MIMO) and Beam correspondence are verified only under normal thermal conditions. Companies still share different views on whether these requirements are defined based on NTC or not. **Proposal 1: Based on the clear applicability of the requirements of Power control (Single carrier/CA), EVM/ EVM spectral flatness (Single carrier/CA/UL MIMO), RAN4 can conclude that these requirements are only for NTC.** **Proposal 2: RAN4 should limit the ETC requirement discussion on spherical coverage and beam correspondence, and further discuss the necessity on ETC test for these two RF requirements.****Proposal 3: RAN4 need to study the impacts of spherical coverage and beam correspondence requirements under ETC, or define new requirements for ETC spherical coverage and ETC beam correspondence.****Proposal 4: A simulation campaign is needed to calculate the impacts of temperature on spherical coverage and beam correspondence.****Proposal 5: Send a LS to RAN5 to clarify the applicability of RF core requirement with applicability restrained to NTC.** |
| [**R4-2111508**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111508.zip) | Keysight Technologies UK Ltd | **Observation 1: Unless otherwise stated, all core requirements are applicable either under nominal or extreme environmental testing conditions.****Proposal 1: RAN4 to confirm that, unless otherwise stated, all core requirements are applicable under nominal and extreme environmental testing conditions.****Proposal 2: RAN4 to confirm that existing EIRP/EIS spherical coverage core and beam correspondence core requirements apply under extreme temperature conditions. Hence changes described in [11] (R4-2111507) are agreeable.** |
| [**R4-2111507**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111507.zip) | Keysight Technologies UK Ltd | Notes indicating core requirements are only applicable under normal thermal conditions are voided. |

Other maintenance CR to TS 38.101-2 is listed in the following, together with companion discussion papers.

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2108787**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108787.zip) | Qualcomm Incorporated | “each” is replaced by “all” and *cell* is changed to its plural *cells* to clarify that UE uses grants for all cells to determine Pcmax.  |
| [**R4-2108819**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108819.zip) | Qualcomm Incorporated | **Proposal 1: Make the** Pmin **requirement (6.3.1, 6.3x.1) consistent across all use-cases by scaling the requirement with baseband BW (Number of UL layers \* RF bandwidth).****Observation 1: The ‘shared gain’ approach of adopting the Pmin requirement for 100 MHz channels as the new Pmin PSD requirement represents both, a 3 dB relaxation of UE RF requirements and a 3 dB network improvement for 50 MHz deployments.****Proposal 2: The PC2/3/4 Pmin requirement shall be scaled from a Pmin PSD requirement of -13 dBm per 100 MHz of baseband bandwidth.****Proposal 3: The PC1 Pmin requirement shall be scaled from a Pmin PSD requirement of +4 dBm per 100 MHz of baseband bandwidth.****Proposal 4: The PC5 Pmin requirement shall be scaled from a Pmin PSD requirement of -6 dBm per 100 MHz of baseband bandwidth.** |
| [**R4-2108820**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108820.zip) | Qualcomm Incorporated | CR for the above discussion paper |
| [**R4-2108872**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108872.zip) | Rohde & Schwarz | Merged tables for 60 and 120 kHz SCS.Removed redundant information.Removed tables for 120 kHz SCS. |
| [**R4-2108875**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108875.zip) | Rohde & Schwarz | Change IBE requirements to the same metrics as other emission measurements.Added statement that defines the requirements in Tx beam peak direction. |
| [**R4-2110151**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110151.zip) | Apple | Proposal 1: RAN4 shall apply the corrected values for the minimum SSB and minimum CSI-RS as provided in Table 1 and Table 2. |
| [**R4-2110176**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110176.zip) | Apple | The CR for the above discussion paper. |
| [**R4-2111358**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111358.zip) | Huawei, HiSilicon | Adding sentence for CA SEM and CA spurious requirement: the LO leakage and IQ image may land outside configured UL and DL CCs |
| [**R4-2111364**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111364.zip) | Huawei, HiSilicon | Add MBR requirements for UEs support multiple FR2 band. |
| [**R4-2111415**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111415.zip) | Qualcomm Incorporated | Create definition in section 3, and remove multiple duplicated definitions in body of requirements |

## Open issues summary

EESS protection issue is discussed in Sub-topic 4-1 and ETC issue is in Sub-topic 4-2. For other maintenance CRs, leave comments in 4.3.2.

### Sub-topic 4-1 EESS protection

**Issue 4-1: EESS protection (WRC-19)**

* Proposals
	+ Option 1: Postpone defining the 2024/2027 requirements, NS\_203 approach can be used as reference in future. (OPPO)
	+ Option 2: Introduce NS\_20Y (-5dBm/200MHz protection for n257/n258 applied after 2027) into standard now and use normative or informative notes like ‘applicable from <calendar date>’ to indicate the changeover dates (handling of NS\_20X is FFS) (NTT Docomo)
* Recommended WF
	+ Collect comments in the first round.

### Sub-topic 4-2 RF requirement applicability under ETC

**Issue 4-2-1: RF requirement applicability under ETC**

* Proposals
	+ Option 1: Power control (Single carrier/CA), EVM/ EVM spectral flatness (Single carrier/CA/UL MIMO) are only for NTC; discuss ETC requirement only for spherical coverage and beam correspondence. (vivo)
	+ Option 2: All core requirements are applicable under nominal and extreme environmental testing conditions unless otherwise stated. Existing EIRP/EIS spherical coverage core and beam correspondence core requirements apply under extreme temperature conditions (Keysight)
	+ Option 3: others
* Recommended WF
	+ Collect comments in the first round.

**Issue 4-2-2: Spherical coverage and beam correspondence requirement under ETC (Next step)**

* Proposals
	+ Option 1: A simulation campaign is needed to calculate the impacts of temperature on spherical coverage and beam correspondence. (vivo) (Moderator questions if this is a proposal to SI FR2 testability? Should it be handled in this agenda?)
	+ Option 2: other.
* Recommended WF
	+ Collect comments in the first round.

**Issue 4-2-2: CR to 38.101-2**

* Proposals
	+ Option 1: Agree CR R4-2111507, i.e., notes indicating core requirements are only applicable under normal thermal conditions are voided in EIRP/EIS spherical coverage and beam correspondence requirements (Keysight)
	+ Option 2: No CR yet. Or revision needed.
* Recommended WF
	+ Collect comments in the first round.

**Issue 4-2-3: LS to RAN5**

* Proposals
	+ Option 1: Send LS to RAN5 about RAN4 status according to R4-2109671 (vivo)
	+ Option 2: No LS yet. Or revision needed.
* Recommended WF
	+ Collect comments in the first round.

## Companies views’ collection for 1st round

### Open issues

Sub topic 4-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Option 1 |
| OPPO | Option 1. And this has been discussed for several meetings, most companies prefer following the handling of introducing NS\_203 which is a good example in introducing future requirements. |
| Huawei | Prefer postpone. Whether NS\_203 can be reference need further discussion, Tighter requirement is meaningless if a loose requirement is still allowed. |
| DOCOMO | Option 2:We narrowed down our proposal to focus n257 compared to the proposal in the previous meeting.And as discussed in R4-2111509, we have concerns on option 1 above, and if we do not introduce the requirements now, we need to capture a clear guidance especially for mandatory indication of modified MPR somewhere in TS or TR so that we will be able to implement it in specification correctly when it is needed. And wording should be modified not to use “postpone” to avoid the situation where the related discussion will be not allowed although it is really necessary.  |

Sub topic 4-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| vivo | Issue 4-2-1: RF requirement applicability under ETCSupport Option 1. For spherical coverage and beam correspondence, we still need to discuss the applicability and relaxation. Issue 4-2-2: Spherical coverage and beam correspondence requirement under ETC (Next step):Support option1. Clarification feedback to moderator: the test method part is close to be finalized in testability SI, the open issue is whether some RF requirements should be tested under ETC (or defined based on ETC assumption). Option 1 is for RF core requirement relaxation, based on guidance from Vice-chair during GTW session, modification of any RF core requirement should be discussed and concluded in this agenda. Issue 4-2-3: CR to 38.101-2Can not agree the CR. The applicability of some RF requirements is not concluded yet.Issue 4-2-3: LS to RAN5LS is needed in this meeting. RAN5 is discussing in parallel whether to test all the FR2 RF test cases under ETC, this is highly dependent on the applicability of RF core requirements in RAN4. Therefore, clear guidance from RAN4 should be informed to RAN5 ASAP, to avoid making incorrect conclusion of ETC conformance test cases in RAN5. |
| MediaTek | **Issue 4-2-1: RF requirement applicability under ETC**Support Option 1, and echo vivo’s comment “For spherical coverage and beam correspondence, we still need to discuss the applicability and relaxation.” **Issue 4-2-2: Spherical coverage and beam correspondence requirement under ETC (Next step):**Support Option1. Evaluate the impact by simulation is important.**Issue 4-2-3: CR to 38.101-2**Support Option 2. There is no consensus so far.**Issue 4-2-3: LS to RAN5**Support Option1. Sync-up with RAN5 for the latest RAN4 status is good. |
| Samsung | **Issue 4-2-1: RF requirement applicability under ETC**Support Option 3: others Partial statement of option 1 is okay, i.e. Power control (Single carrier/CA), EVM/ EVM spectral flatness (Single carrier/CA/UL MIMO) are only for NTC;Partial statement of option 2 is also okay, i.e. All core requirements are applicable under nominal and extreme environmental testing conditions unless otherwise stated.But about ETC requirement for spherical coverage and beam correspondence, our preference is to keep the current core requirement, i.e., only applicable for NTC.Recalling the Rel-15 ETC requirement discussion, testability is not the only reason for limiting spherical coverage applicability to NTC. Rel-15 requirements for peak and spherical were derived based on NTC. There were arguments and contributions that both peak and spherical coverage requirements should be only applicable to NTC. Now the TR38.817-01 also indicates so. However, there was also consideration on regulation (R4-1815055) on peak requirements under ETC. So the final consensus in Rel-15 is to adopt the same peak requirements under ETC as NTC, but only apply spherical requirements to NTC. It is more like a compromise than due to testability limitation only.On the other hand, it is not clear whether it is necessary to test spherical performance under ETC. it is also experience in LTE stage that some test cases are verified only at NTC and some test cases are verified at ETC also. Considering maximum output power has been verified with peak EIRP/EIS under ETC, it seems not so meaningful to test spherical EIRP/EIS again under ETC, but just to add burden to vendors. It is not so convinced to change this core requirement only because we can test it now.**Issue 4-2-2: Spherical coverage and beam correspondence requirement under ETC (Next step)**Pending on Issue 4-2-1**Issue 4-2-3: CR to 38.101-2**Support Option 2: No CR yet. Pending on Issue 4-2-1**Issue 4-2-4: LS to RAN5**Support Option 2: No LS yet. Pending on Issue 4-2-1 |
| OPPO | **Issue 4-2-1: RF requirement applicability under ETC**Option 3, and agree with Samsung that when defining the core requirements in Rel-15 many aspects have been considered and compromise have been adopted in the end. Although the discussion in RAN4 should focus on the requirement definition rather than the testing, in the Rel-15 RAN4 discussion it is inevitably that the testing is involved due to the long testing time and burden in specifying both ETC and NTC. So the agreement in Rel-15 is not just based on the TE ability of ETC, but because of compromise in the group. And we don’t think it is proper to change Rel-15 spec at this late stage just because of companies say TE now can do it.Besides, we have question on the ETC TE ability, is there conclusion of how the ETC box will affect the UE beam direction, and beam EIRP?**Issue 4-2-2: Spherical coverage and beam correspondence requirement under ETC (Next step)**Option 2, no ETC needs to be tested. And it needs to understand better on how the ETC box will affect the UE beam direction and beam EIRP before discussing whether the current requirement is applicable to ETC.**Issue 4-2-2: CR to 38.101-2**Option 2.**Issue 4-2-3: LS to RAN5**Option 2. Need conclusion in RAN4 first. |
| Apple | Issue 4-2-1: Option 1Issue 4-2-2: Option 1 A simulation campaign is needed to calculate the impacts of temperature on spherical coverage and beam correspondence.Issue 4-2-3: CR to 38.101-2Option 2: No CR yet. Our view is simulation campaign needs to be concluded first before CR consideration.Issue 4-2-4: LS to RAN5Option 1 if Issue 4-2-1 can be concluded. |
| Keysight | Issues 4-2-1 and 4-2-2:The proposals in R4-2111508 where not excluding each other: * On one hand, the intention was to confirm that existing core requirements not indicating in current specifications to be applicable only under normal temperature conditions are also applicable under Extreme temperature conditions as indicated in Annex E.2.1 in 38.101-2.

The options we see under Issue 4-2-1 are:New Option 3: Current specification is correct, and all core requirements not explicitly limited to normal testing conditions are applicable also under Extreme temperature conditionsNew Option 4: Any of the core requirements not explicitly limited to normal testing conditions should be revisited for extreme temperature conditions.* Additionally, it pretended to confirm whether EIRP/EIS spherical coverage and beam correspondence applicability limitation to Normal temperature conditions was related to FR2 ETC feasibility.

In this case, we understand Option 1 as “They were not limited only to normal temperature conditions due to FR2 ETC testability issues and new simulations are required to decide whether any relaxation is required under ETC (worthy to have ETC requirements)”.A possible “Option 2: They were limited to normal temperature conditions only due to FR2 ETC testability issues and restrictions to Normal temperature conditions can be removed”.A possible “Option 3: When those requirements were defined, it was agreed that there was no need to define ETC requirements. Specification will remain unchanged”With this redefinition of the options, Keysight view is:Issue 4-2-1: New Option 3Issue 4-2-2: Neutral. |
| LG | **Issue 4-2-1: RF requirement applicability under ETC**Option 1, and introduction of spherical coverage and beam correspondence test under ETC should be carefully considered.**Issue 4-2-2: Spherical coverage and beam correspondence requirement under ETC (Next step)**Option 1. If the simulation campaign is for studying core requirement relaxation, we think that this study should be handled other or new WI not maintenance. **Issue 4-2-2: CR to 38.101-2**Option 2. No CR yet.**Issue 4-2-3: LS to RAN5** Option1 if other issues are resolved.  |
| Huawei | **Issue 4-2-1: RF requirement applicability under ETC****We don't think Rel-15 RF requirements need to be revisited at this stage. Spherical coverage requirement is clearly clarified in TS 38.101 that only under NTC, and this conclusion is not only consideration of test applicability issue.** **Issue 4-2-2: Spherical coverage and beam correspondence requirement under ETC (Next step):****Similar as for 4-2-1.****Issue 4-2-3: CR to 38.101-2****No need of CR currently.****Issue 4-2-3: LS to RAN5****LS would be OK, but we prefer not to revisit spherical coverage and BC under ETC for NR Rel-15.** |
| Nokia | Issue 4-2-1: Option 2Issue 4-2-2: CR to 38.101-2: Option 1Issue 4-2-3: LS to RAN5: Option 2 |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| [**R4-2108787**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108787.zip) | Samsung: Agree with the general idea, but the wording “all serving cells c” seems a little misleading, i.e., one may interpret “c” as many cells. Usually *f*(*c*) is considered as a function of single cell c.ZTE: Should the symbol of ‘carrier f(c)’ be corrected to ‘carrier f’?It seems the symbol of ‘carrier f(c)’ means carrier f of each serving cell c according to the original sentence.Ericsson: agreed. |
| [**R4-2108819**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108819.zip)[**R4-2108820**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108820.zip) | Apple: We support the Pmin scaling proposal and the CR.Samsung: OK with this CR.DOCOMO: OK with this CR as long as the scaling is based on 100MHz CBW.OPPO: OKHuawei, HiSilicon: On one hand, min output power is also decided by RF component that the value we prefer to be not lower down, for example, -13dBm for PC2/3/4. -16dBm makes requirement more stringent.On the other hand, min output power is required for 1RB or full RB over a channel bandwidth. If -16dBm/50MHz and -13dBm/100MHz is defined, then for 50MHz and 1RB allocated, -16dBm is also required, and similarly for 100MHz and 1RB allocated, -13dBm is required. Consider 2UEs with different CBW under one cell, both are allocated with 1RB within their CBW, but different PSD can be reached, that would have impact on gNB demodulation since the PSD from UEs are different.So the requirement is better with:Full RB, with power scaling method:But for the same RB number for different CBW, the minimum output power requirement is the same.For example, 100MHz with 132 RB and 50MHz with 66RB, for RB number from 67-132, use power scaling method scaling in RB number. For RB number from 1-66, the min output power requirement is the same. |
| [**R4-2108872**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108872.zip) | Samsung: OK with this CR |
| [**R4-2108875**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108875.zip) | Samsung: agree with the logic behind. One comment is, how about treating carrier leakage together with IBE as sum of emissions considering IBE also contains carrier leakage? Another comment is that an implementation-agnostic wording instead of “both polarizations” may be better, e.g. “both transmission ports”, “both transmission branches” etc.Rohde & Schwarz: In response to Samsung: For carrier leakage, we think that there are two cases, a) it falls on allocated RBs, then it does not affect IBE, b) it falls on non-allocated RBS in that case, it can be compensated. Regarding the wording change, actually in our understanding “both polarizations” refers to the measurement polarizations, which do not necessarily with the UE polarization/transmission port/ etc. This is independent of the UE implementation.Apple: we agree that IBE should be measured as the sum of emissions in both UL polarizations. Overall, this CR looks good to us. |
| Anritsu:Agree. In addition to the contents in this CR, we’d like to discuss also on the requirement of carrier leakage. It might be necessary that the TPMI index is limited only to 0. We assume that an obtained result of carrier leakage under TPMI index 0 condition is aligned with the current test purpose and can be judged based on per layer. However other cases than TPMI index 0 may not be valid since the carrier leakage from one UE Tx chain can be contained in both of layers. Suppose the UE has two Tx chains (Tx UE chain 1 and 2), a carrier leak from the Tx UE chain 1 under TPMI index 0 can be measured either layer 1 or layer 2. And same applies to another carrier leak from the Tx UE chain 2. However, in a case of other TPMI indices, a carrier leak from the Tx UE chain 1 (and Tx UE chain 2) can be contained in both layer 1 and layer 2. Considering the test purpose that the carrier leak is to verify the RF performance of each UE Tx chain, measuring the mixed carrier leak in each layer does not seem an appropriate method.  |
| [**R4-2110151**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110151.zip)[**R4-2110176**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110176.zip) | Samsung: agree with this CR. Original data was based on bandwidth, so there was 0.2dB difference compared with the calculation based on PRB numbers.Huawei, HiSilicon: the equation define min RP in the discussion paper is not aligned with Rel-15 agreement. So we cannot accept the revision. |
| [**R4-2111358**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111358.zip) | Apple: What is the purpose for adding this sentence?Samsung: this CR is reasonable. For non-contiguous CA, carrier leakage and IQ image may land outside the configured CCs. Maybe the wording can be refined from “LO leakage” to “carrier leakage”OPPO: Technically is ok, but is the intention to make exceptions for the SEM and general spurious emission requirements? If it is then the exception statements should also be there. |
| [**R4-2111364**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111364.zip) | Apple: The intention for this CR is understandable. But the wording of the added sentences can be improved if the CR would be agreeable. Also the contents between clause 6.1 and clause 6.6 were missing without a section divider.Samsung: we think common understanding is that MBR is part of minimum peak and spherical coverage requirements. For further clarification to avoid confusion, another way is that the beam correspondence requirements refers to “sub clause 6.2.1…” instead of “Table 6.2.1…”DOCOMO: Current TS 38.101-2 specifies MBR for only PC3, so clarification is needed as following:For section 6.1*Unless otherwise stated, UE multi-band relaxation factors defined in Table 6.2.1.3-4 is fulfilled for the* ***power class 3*** *UEs that support multiple FR2 bands.*For section 6.6, we think we should just refer to “sub clause” not “Table”, as Samsung mentioned above.Huawei, HiSilicon: To Apple, we could improve the wording as your suggestion.Nokia: text is very unclear, what does "fullfilled" mean here? |
| [**R4-2111415**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111415.zip) | Samsung: it is observed that the CABW definition between Rel-15 and Rel-16/17 are different. In Rel-16/17, CABW is defined within bidirectional spectrum. If we agree this Rel-15 CR, not sure how do we handle the mirror CR. We notice that CABW definition of Rel-16/17 is compatible with that of Rel-15, is it possible to apply the Rel-16/17 CABW definition to Rel-15 specification? In the Definition section, an aligned definition among releases seems better if possible. |

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

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

# Topic #5: intra/inter-band Contiguous/Non-Contiguous MRDC

## Companies’ contributions summary

A list of contributions regarding contiguous/non-contiguous MRDC issues is found in the following table.

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2110032**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110032.zip) | NTT DOCOMO INC. | **Observation 1: interBandContiguousMRDC is a similar UE capability to intraBandENDC-Support but applies to intra band-basis inter band EN-DC such as DC\_42\_n77 and DC\_42\_n78. The difference between these capabilities is that supportiveness of non-contiguous is mandatory for interBandContiguousMRDC.****Proposal 1: Agree CR (R4-2108803) [6] to correct the description of NOTE4** **in Table 5.5B.4.1-1 in TS 38.101-3 based on the previous agreements.****Proposal 2: Apply the following interpretation for intra band contiguous and non-contiguous EN-DC related to intraBandENDC-Support and interBandContiguousMRDC capability:*** **If UE supports the case where one of LTE carriers is contiguous with one of NR carriers, UE needs to indicate contiguous EN-DC capability.**
* **If UE supports the case where one of LTE carriers is non-contiguous with one of NR carriers, UE needs to indicate non-contiguous EN-DC capability.**
* **If UE supports above both cases, UE needs to indicate both contiguous and non-contiguous EN-DC capability.**
* **The interpretation should be applied to both UL and DL.**

**Applicability to UL parts can be revisited if some issues are identified.** |
| [**R4-2108803**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108803.zip) | NTT DOCOMO INC. | CR for the above discussion paper regarding inter-band MRDC.  |
| [**R4-2109781**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109781.zip) | Nokia, Nokia Shanghai Bell | **Proposal 1: For UE supporting the intra-band non-contiguous EN-DC for the number of carriers (combined both LTE and NR) more than two shall support the contiguous EN-DC as well.****Proposal 2: UE is not allowed to signal only the support of the intra-band non-contiguous EN-DC if the number of carriers (combined both LTE and NR) are more than two.****Proposal 3: All carriers (between LTE carrier and NR carrier, within LTE carriers or within NR carriers, both UL and DL) shall be contiguous, if UE indicates only the support of intra-band contiguous EN-DC, without the support of non-contiguous EN-DC.****Proposal 4: The same BCS shall be applied between contiguous and non-contiguous EN-DC.** **Proposal 5: For mixed intra-band and inter-band EN-DC (for example DC\_48A\_n48A-n71), the UE capability definition is applied to the intra-band part (DC\_48A\_n48A) of the carriers.** **Proposal 6: The multiple intra-band EN-DC components (for example, DC\_48A-71A\_n48A\_n71A) shall not be allowed (at least by this 3GPP release (Rel-17)).****Proposal 7: Inform RAN2 about RAN4 understanding of this UE capability.** |
| [**R4-2109782**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109782.zip) | Nokia, Nokia Shanghai Bell | CR for the above discussion paper. |
| [**R4-2110154**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110154.zip) | Apple | ***Observation 1****: Irrespective of how many CCs are configured in each cell group, each cell group should always allow its own configuration to fall back to its primary cell only.****Observation 2****: RAN2 signalling design for intra-band EN-DC combinations includes LTE DL CA configuration, LTE UL CA configuration, NR DL CA configuration, NR UL CA configuration, and the EN-DC part of the configuration is signalled by the parameter intraBandENDC-support.****Observation 3****: If a UE is capable of supporting non-contiguous configuration in either DL or UL, it should also be able to support contiguous configuration in the corresponding DL or UL, but not the other way around.****Proposal 1****: For intra-band EN-DC, contiguous or non-contiguous is determined by the configuration between the primary cells from each cell group.* ***Proposal 2****: Only the configuration between LTE and NR sub-blocks are relevant to the contiguous or non-contiguous definition of the intra-band EN-DC combinations.* ***Proposal 3****: The existing RAN2 signalling design is sufficient to indicate UE’s support for different intra-band EN-DC configurations. There is no need to introduce new signalling to differentiate intra-band DL and UL EN-DC configurations separately.* |
| [**R4-2110155**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110155.zip) | Apple | CR for the above discussion paper. |
| [**R4-2110156**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110156.zip) | Apple | Rel-16 CR for the above discussion paper. |
| [**R4-2110807**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110807.zip) | OPPO | ***Observation 1: Current spec doesn’t consider the UL CC locations when specify the intra-band contiguous or non-contiguous EN-DC.******Observation 2: In current spec the band combination is considered as intra-band contiguous only when all the DL CCs are contiguous.******Observation 3: The DL and UL capability in supporting intra-band contiguous or non-contiguous is different, and new signaling might be needed then release independent will be a problem.******Observation 4: For current intra-band contiguous EN-DC case2 (e.g. DC\_(n)41CA with UL DC\_41A\_n41A), NW can only fall back to intra-band non-contiguous EN-DC, i.e. DC\_41A\_n41A which will violate 38.306 fallback restriction.******Observation 5: If consider the intra-band contiguous EN-DC only based on PCC and PSCC, then the 38.306 fallback restriction (non-contiguous is not a fallback of contiguous) can be aligned.******Observation 6: No new capability signaling is needed to differentiate UL and DL, if classify the intra-band contiguous or non-contiguous EN-DC only based on the PCC and PSCC.******Proposal 1: It is proposed to*** ***interpret intra-band EN-DC contiguous or non-contiguous based on the PCC and PSCC and no new signaling need to be defined.******Observation 7: Current RAN2 signaling cannot differentiate the two band combinations, i.e. DC\_48A\_(n)48AA and DC\_48A-48A\_n48A both with UL DC\_48A\_n48A.******Observation 8: An alternative is to classify the intra-band contiguous EN-DC by the condition that CCs between LTE and NR are contiguous and remove the 38.306 band combination fallback restriction.******Proposal 2: It is proposed to*** ***further consider classify the intra-band contiguous EN-DC by the condition that there are CCs between LTE and NR are contiguous and remove the 38.306 band combination fallback restriction if the proposal 1 approach is not doable.*** |
| [**R4-2110982**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110982.zip) | Qualcomm Incorporated | **Proposal 1: Adopt option 2. The entire LTE and NR spectrum are contiguous, i.e., all carriers are contiguously spaced. In other word, all the adjacent carriers including intra LTE carriers and intra NR carriers are contiguously spaced.****Observation: Separate signaling for UL and DL enables greater flexibility to support different EN-DC scenarios and is recommended to be introduced in Rel-16. If separate signaling is not available for Rel-15, then the lowest capability between UL and DL should be reported where the lowest capability is regarded as C-only. Some scenarios will not be able to be configured by the network as a consequence.****Proposal 2: EN-DC C-to-NC fallback is not required to be supported by the UE. On the other hand, it is expected that the UE supports NC-to-C fallback.****Proposal 3: The UE RF requirements for intra-band contiguous and non-contiguous EN-DC should be updated to reflect the possibility of intra-band contiguous or non-contiguous CA within the E-UTRA and/or NR cell group. The principle that contiguous carriers, whether they are E-UTRA or NR, are treated as a single sub-block while non-contiguous carriers are treated independently should apply.** |
| [**R4-2111111**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111111.zip) | Google Inc. | **Observation 1: The DC\_48A\_(n)48AA with UL DC\_48A\_n48A is an intra-band non-contiguous EN-DC band combination.****Proposal 1: Do not introduce the new signaling for intra-band EN-DC UL and DL configuration.****Proposal 2: Redefine the following intra-band EN-DC combination** * **DC\_(n)48CA with UL DC\_48A\_n48A is an intra-band non-contiguous EN-DC combination**
* **DC\_48A\_(n)48AA with UL DC\_(n)48AA is an intra-band contiguous EN-DC combination**
 |
| [**R4-2111353**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111353.zip) | Huawei, HiSilicon | ***Observation 1: In TS 38.101-3, contiguous or non-contiguous EN-DC is defined only based on DL configuration.*** ***Observation 2: UE is not allowed to indicate intra-band EN-DC contiguous/non-contiguous capability in UL or DL separately.******Proposal 1: IntraBandENDC-Support IE should be indicated in UL and DL separately per band combination. Send LS to RAN2 to introduce new UE capability on distinguish intra-band ENDC UL and DL contiguous/non-contiguous support.******Proposal 2: Ask RAN2 to early implement intraBandENDC-Support IE in UL and DL separately per band combination in Rel-15 spec.*** |

## Open issues summary

### Sub-topic 5-1 Intra-band EN-DC

**Issue 5-1-1: intraBandENDC-Support definition**

* Proposals
	+ Option 1: For intra-band EN-DC, contiguous or non-contiguous is determined by the configuration between the primary cells from each cell group. (Apple, OPPO)
	+ Option 2: The entire LTE and NR spectrum are contiguous, i.e., all carriers are contiguously spaced for contiguous EN-DC. (Qualcomm, Nokia, [NTT Docomo?])
		- Option 2a: If separate UL/DL signaling is not available, then the lowest capability between UL and DL should be reported where the lowest capability is regarded as C-only. Some scenarios will not be able to be configured by the network. (Qualcomm)
		- Option 2b: Not allowed only signaling non-contiguous for more than two carriers. Both must be signaled for all possible mixed configurations (Nokia)
	+ Option 3: If UE supports the case where one of LTE carriers is contiguous with one of NR carriers, UE needs to indicate contiguous EN-DC capability. If UE supports the case where one of LTE carriers is non-contiguous with one of NR carriers, UE needs to indicate non-contiguous EN-DC capability. If UE supports above both cases, UE needs to indicate both contiguous and non-contiguous EN-DC capability. The interpretation should be applied to both UL and DL. (NTT Docomo)
	+ Option 4: IntraBandENDC-Support IE should be indicated in UL and DL separately per band combination. (Huawei, Qualcomm)
	+ Option 5: Redefine DC\_(n)48CA with UL DC\_48A\_n48A non-contiguous, DC\_48A\_(n)48AA with UL DC\_(n)48AA contiguous not to violate fallback operation (Google)
* Recommended WF
	+ Collect views in the 1st round.

**Issue 5-1-2: Impact to UE capability signaling**

* Proposals
	+ Option 1: Ask RAN2 to introduce or modify UE capability signaling.
		- Option 1a: Change needed from Rel-15. (Huawei)
		- Option 1b: Keep Rel-15 signaling. Introduce enhancement from Rel-16.
	+ Option 2: No new signaling is needed (Apple, Google)
		- Option 2a: Some clarification of existing signaling may be needed in RAN2.
		- Option 2b: No change at all to RAN2 is needed.
* Recommended WF
	+ Collect views in the 1st round.

**Issue 5-1-3: Fallback from C to NC and NC to C.**

* Proposals
	+ Option 1: Fallback from C to NC is not required but NC to C is required. (Qualcomm)
	+ Option 2: None of cross C-NC fallbacks is required.
	+ Option 3: It depends on UE capability.
		- Option 3a: UE capable of both C and NC can support the fallback from C to NC, as well as from NC to C.
		- Option 3b: others
	+ Option 4: Removing RAN2 38.306 fall back restriction might be needed. (OPPO)
* Recommended WF
	+ Collect views in the 1st round

**Issue 5-1-4: UE RF requirement update**

* Proposals
	+ Option 1: The UE RF requirements for intra-band contiguous and non-contiguous EN-DC should be updated to reflect the possibility of intra-band contiguous or non-contiguous CA within the E-UTRA and/or NR cell group. (Qualcomm)
	+ Option 2: UE RF requirement change is not required.
* Recommended WF
	+ Collect views in the 1st round

**Issue 5-1-5: BCS issue**

* Proposals
	+ Option 1: The same BCS shall be applied between contiguous and non-contiguous EN-DC. (Nokia)
	+ Option 2: Others
* Recommended WF
	+ Collect views in the 1st round

**Issue 5-1-6: Mixed intra and inter-band EN-DC**

* Proposals
	+ Option 1: For mixed intra-band and inter-band EN-DC (for example DC\_48A\_n48A-n71), the UE capability definition is applied to the intra-band part (DC\_48A\_n48A) of the carriers. The multiple intra-band EN-DC components (for example, DC\_48A-71A\_n48A\_n71A) shall not be allowed (at least by this 3GPP release (Rel-17)). (Nokia)
	+ Option 2: Others
* Recommended WF
	+ Collect views in the 1st round

### Sub-topic 5-2 Inter-band EN-DC

**Issue 5-2: interBandContiguousMRDC**

* Proposals
	+ Option 1: The minimum requirements for intra-band non-contiguous EN-DC apply (always). When interBandContiguousMRDC is indicated, the minimum requirements for both intra band contiguous and non-contiguous EN-DC apply. Approve R4-2108803. (NTT Docomo)
	+ Option 2: Other than Option 1
* Recommended WF
	+ Option 1

If UE supports the case where one of LTE carriers is contiguous with one of NR carriers, UE needs to indicate contiguous EN-DC capability. If UE supports the case where one of LTE carriers is non-contiguous with one of NR carriers, UE needs to indicate non-contiguous EN-DC capability. If UE supports above both cases, UE needs to indicate both contiguous and non-contiguous EN-DC capability. The interpretation should be applied to both UL and DL.

## Companies views’ collection for 1st round

### Open issues

Sub topic 5-1-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Option 1 and Option 5 |
| Verizon | Option 3 is clearer although there are a lot similarity from other options.  |
| OPPO | Option 1 |
| Ericsson | None of the options listed, but the NTT DOCOMO proposal in R4-2110032 is acceptable. This proposal appears to be consistent with the Ericsson CR in R4-2109968 (for Rel-16) moved to this thread.No changes to RAN2 specification are needed with certain restrictions on band combinations if1. fallback from C to NC is not allowed as per the existing 38.306, UL configurations cannot be NC if the DL is contiguous. In case the UL configuration is NC, the UE has to include an additional band combination with a corresponding NC DL configuration in its list of supported band combinations.2. the contiguous EN-DC sub-block consist of one E-UTRA and one NR sub-block of the EN-DC band class as specified in Table5.3B.0-1. Then intraBandENDC-Support is absent.3. For combinations of C and NC EN-DC (e.g. DC\_48A-(n)48AA) there can be at most *two* NC EN-DC sub-blocks one of which is to the type in Table 5.3B.0-1, the other either an E-UTRA or an NR sub-block. For these the UE lists three sub-blocks with intraBandENDC-Support = “both”. This can also be indicated for *two* sub-blocks, e.g. DC\_(n)48AA and DC\_48A-n48.4. For NC combinations of E-UTRA and NR sub-blocks, there can be an arbitrary number of sub-blocks (each either E-UTRA or NR) when intraBandENDC-Support = “non-contiguous”. Then there is no need for any changes of the RAN2 specifications, but the EN-DC UL/DL configurations in 38.101-3 must be modified, see R4-2109968.No need to distinguish UL and DL, the possible UL configurations can be indicated. |
| MTK | Our preference is to minimize RAN2 impact as much as possible. If needed, only consider Rel-16 and onward to avoid NBC issues. Option 1 is slightly preferred, but we are also open other options. |
| Huawei | **For option1, it is far from clearly indicating UE capability to the network. For DC\_(n)48CA, contiguous or non-contiguous would be decided by network Pcell configuration. For this configuration, if UE indicate contiguous support, option 1 means only** **DC\_(n)48AA can be configured to the UE, but UE may support DC\_48A\_n48A in UL. UE capability can not transferred to the network, and UE RF ability is just wasted, and NB configuration is obviously limited.****For option2, entire LTE and NR spectrum are contiguous is defined as contiguous, this option is not aligned with the contiguous definition for ENDC, meanwhile, separate UL and DL indication is still needed for such definition, because this option2 is still based on DL spectrum. With option 2a and 2b, obviously scheduling limitation is there.****For option 3, good to have separate definition for UL and DL, then separate signalling would be necessary.****For option 5, the problem is not definition on configuration, the problem is network can not get the information for UL and DL separately. Even we redefine** DC\_(n)48CA with UL DC\_48A\_n48A non-contiguous, if UE indicate non-contiguous support, how could gNB know whether DC\_48A\_n48A with UL DC\_48A\_n48A can be configured to the UE?So we support option 4. |
| DOCOMO | Option 3Question for option 1 is that if we consider a band combination including another LTE anchor band such as DL\_1A\_48A\_n48A\_UL\_1A\_n48A, intra-band EN-DC exists in only DL but LTE Pcell is not a part of intra-band EN-DC, then how does option 1 work?Regarding option 2, let us clarify our understanding on the delta between option 2 and 3. Regarding DC\_48A\_(n)48AA, option 2 require non-contiguous capability while option 3 requires both contiguous and non-contiguous capability.So, in option 2, even if UE indicate non-contiguous only capability, i.e., not indicate contiguous capability, NW assumes that UE can support DC\_48A\_(n)48AA. But we think DC\_(n)48AA is fallback of DC\_48A\_(n)48AA, so the UE should support contiguous capability as well. That why option 3 requires UE to indicate both contiguous and non-contiguous capability.But we also found proposal 1 in R4-2109781:*Proposal 1: For UE supporting the intra-band non-contiguous EN-DC for the number of carriers (combined both LTE and NR) more than two shall support the contiguous EN-DC as well.*Does this mean that UE supporting DC\_48A\_(n)48AA need to indicate both contiguous and non-contiguous capability?If no, that is, UE indicating non-contiguous capability is assumed to support both contiguous and non-contiguous configuration, an issue from our side is that interBandContgiuousMRDC capability does not work well since it assumes non-contiguous capability is always supported.  |
| Nokia | RF capability does not depend on which cell is Pcell or Scell in downlink. So Option 1 looks odd to us.One possible option is to remove controversial combinations from Rel-15 and fix the issues in Rel-16 as a clean slate solution including the necessary changes to signaling. |

Sub topic 5-1-2

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| **Company** | **Comments** |
| Apple | Option 2 |
| Verizon | Option 2a |
| OPPO | Others, as discussed in our paper R4-2110807 no new capability signaling is needed to differentiate UL and DL, if classify the intra-band contiguous or non-contiguous EN-DC only based on the PCC and PSCC. But it seems currently it is not possible to differentiate the two band combinations i.e. DC\_48A\_(n)48AA and DC\_48A-48A\_n48A both with UL DC\_48A\_n48A, so new signaling might be needed to differentiate them. |
| Ericsson | Option 2b. |
| MTK | Our preference is to minimize RAN2 impact as much as possible. If needed, only consider Rel-16 and onward to avoid NBC issues.  |
| Huawei | We support option 1a. Option 2 will introduce configuration error between UE and gNB. |
| DOCOMO | Option 2. |
| Nokia | We prefer to minimize RAN2 change. If change is needed it should not be for Rel-15 but for later release. |

Sub topic 5-1 -3

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| --- | --- |
| **Company** | **Comments** |
| Apple | Option 1 (for CA)For EN-DC part of the combination, if contiguous or non-contiguous definition is based on the configuration between the primary cells, there would be no cross C-NC fallback. |
| Verizon | Option 2 |
| OPPO | Option 1 is ok for defining contiguous based on the PCC and PSCC.If define contiguous based on any two CCs between PCC and SCC to solve the issue of differentiating the two band combinations i.e. DC\_48A\_(n)48AA and DC\_48A-48A\_n48A both with UL DC\_48A\_n48A,, then option 4 is needed. And as far as we understood, from C to NC restriction in RAN2 is inherent from LTE just to simplify the situation rather than limitation in signaling itself. |
| Ericsson | No need to make any changes to 38.306 and 38.331, but a limit to the EN-DC combinations that can be indicated, see comments to sub-topic 5-1-1. |
| MTK | We do not see a need to change current spec on this issue. |
| Huawei | RAN2 fallback definition is defined from Rel-15, it cannot be changed from now, it will induce incompatible problem. |
| Nokia | We prefer to minimize RAN2 impact (including 38.306) but depending on what we agree in 5-1-1, we may need to change something. |

Sub topic 5-1-4

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| **Company** | **Comments** |
| Apple | Option 1 if found necessary. For DC\_(n)41DA, the maximum aggregated BW is 160 MHz. The current requirements have been defined with aggregated BW up to 160 MHz. |
| Huawei | It is hard to choose one option, because it is not clear on exact content we update for the spec.In our understanding, contiguous configuration need to be revised, only the relation between LTE sub block and NR sub block define the ENDC contiguous or non-contiguous. |
| Nokia | Ok to check the spec impacts. |

Sub topic 5-1-5

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| --- | --- |
| **Company** | **Comments** |
| Apple | Option 2: It is up to operator’s request. |
| Verizon | Option 1 |
| OPPO | Option 2. Different BCS can be applied to contiguous and non-contiguous. |
| MTK | No change is needed according to RAN2 feedback in R4-2107617* If the UE supports an intra-band (NG)EN-DC band combination with both contiguous and non-contiguous configurations, and the supported BCS value(s)(e.g. BCS#0, BCS#1 and so on) for contiguous and non-contiguous is the same, the UE can signal “both” in intraBandENDC-Support with the associated BCS value(s);
* If the supported BCS value(s) for contiguous and non-contiguous is different, the UE can signal two band combination entries for contiguous and for non-contiguous separately, with the associated BCS value(s) respectively;
* If no BCS value(s) is signalled then the BCS#0 is assumed for a band combination
 |
| Huawei | Option 2. Currently, TS 38.101-3 separately define BCS for contiguous and non-contiguous configuration. How could we revise the BCS definition after Rel-15 UE has been commercialized in the market? |
| Nokia | Option 1. Existing BCS looks the same between contiguous and non-contiguous i.e., the bandwidths in CC1 and CC2 are the same for CA\_(n)41AA and DC\_41A\_n41A. We can keep the definition consistent like this way to avoid the RAN2 change.If different BCS is needed between contiguous and non-contiguous, then, there is impact to UE capability signaling. This is because we have only single BCS IE when UE supports both contiguous and non-contiguous. |

Sub topic 5-1-6

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Option 2: Depending on the configuration between the primary cells, the EN-DC can be intra-band or inter-band. |
| OPPO | For clarification, what is the UL CC for DC\_48A-71A\_n48A\_n71A? |
| Ericsson | Option 2: For combinations of C and NC EN-DC (e.g. DC\_48A-(n)48AA) there can be at most two NC EN-DC sub-blocks one of which is to the type in Table 5.3B.0-1, the other either an E-UTRA or an NR sub-block. For these the UE lists three sub-blocks with intraBandENDC-Support = “both”. This can also be indicated for two sub-blocks, e.g. DC\_(n)48AA and DC\_48A-n48.See comments to 5-1-1 and the CR in R4-2109968 (Rel-16) |
| Nokia | For OPPO, it is DC\_48A\_n48A or DC\_71A\_n71A.In any case, we need to fix the issue for the mixed intra and inter-band EN-DC together with the pure intra-band EN-DC case in our understanding, considering the limitations in UE capability signaling. Or we just ask RAN2 to make signaling totally flexile. |

Sub topic 5-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | This is most likely related to the specific combination of DC\_42\_n77 where B42 carrier is adjacent to n77 carrier (contiguous). The requirements should be based on intra-band contiguous configuration. But how to define the requirements can be further discussed as there is no such intra-band EN-DC combination defined.  |
| Verizon  | Option 1 |
| DOCOMO | Option 1This is a clarification based on the previous agreements.To AppleLet us explain more details.DC\_42\_n77 and DC\_42\_n78 are used as not only contiguous but also non-contiguous configuration.And although UL configuration of DC\_42\_n77 and DC\_42\_n78 have not been yet defined, but DL configuration of DC\_42\_n77 and DC\_42\_n78 are used as part of higher layer band combinations such as DL\_1-42\_n78\_UL\_1\_n78. In such cases, UE needs to indicate whether the UE supports DL contiguous configuration between B42 and n78.  |
| OPPO | Option 1 is ok |
| Ericsson | We support the intention of Option 1. The current text of the NOTE is indeed confusing. If requirements apply for the non-contiguous case, why does the UE include the intraBandContiguousMRDC? Absence means support of non-contiguous. Perhaps write that requirements should also be met for contiguous in addition to the non-contiguous case if the capability is included (but the capability seems to be "excusive or") |
| Apple | Thanks NTT DOCOMO for the offline clarification. We are fine with Option 1 as well.On the other hand, the parameter name *interBandContiguousMRDC* could potentially cause the confusion that it was meant to indicate the support of contiguous configuration only. Also technically, we think the signaling is only needed when UE is capable of supporting contiguous configuration only as if UE is capable of supporting non-contiguous configuration, it should always be able to support contiguous configuration (as explained in out paper R4-2110154). So if UE indicates the support of DC\_42A\_n77A or DC\_42A\_n78A already meant mandatory support of non-contiguous configuration, then there is really no need to define another parameter to indicate the support of both contiguous and non-contiguous configurations. To us this parameter is truly redundant. |
| DOCOMO-2 | To EricssonThank you for your suggestion. That is a good point, and we will modify the sentence.To AppleThank you for your further response.If all UE supporting non-contiguous should support contiguous as well, we don’t need this capability since non-contiguous configuration is always mandatory for B42\_n77 and B42\_n78. But when we were discussing it in past, there was a request from a vender that indication of supporting contiguous is needed. Some UE supporting non-contiguous may not support contiguous. That’s why we introduced this capability.  |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

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

# Topic #6: TS 38.101-3 maintenance

## Companies’ contributions summary

Here’s the list of contributions related to the maintenance of TS 38.101-3.

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2108878**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108878.zip) | Rohde & Schwarz | Added missing references to other specifications.Correct table 6.5B.3.3.2-1 Note 10 from -36dBm/MHz to -38dBm/MHz |
| [**R4-2109155**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109155.zip) | SoftBank Corp. | **[Observation-1] There are two different CIM5 used in RAN4 context, on the same or the other side of CIM3.****[Proposal-1] The definition of CIM5 should be clarified first of all.** **[Option-1] CIM5 appears on the other side of CIM3.** **[Option-2] CIM5 appears on the same side of CIM3.** **[Option-3] Other alternatives.****[Proposal-2] The CRs [1] should be revisited if necessary.** |
| [**R4-2109169**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109169.zip) | NTT DOCOMO, INC. | Based on the R4-2103134 agreed in RAN4#98-e, the following requirements will be added.1. Co-existence requirements from DC between Japan band and B40/n40 to Japan bands and PHS.
2. Co-existence requirements from DC between Japan bands to B40.

However, co-existence requirements between n40 and n41 are currently under discussion in RAN4, so they are not included in this CR. |
| [**R4-2109455**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109455.zip) | Apple | 1. CA\_1-28: Added harmonic exception for bands 1, 11, 21 and 65 as they can be affected by scond and third harmonic
2. DC\_2\_n5: Added harmonic exception for bands 31, 43, and 53 as they can be affected by scond and third harmonic
3. DC\_3\_n28: Added harmonic exception for bands 11 and 21 as they can be affected by scond and third harmonic
4. DC\_3\_n51: Added harmonic exception for band 48 as it can be affected by scond harmonic
5. DC\_3\_n82: Added harmonic exception for bands 22, 38, 69 as they can be affected by scond and third harmonic
6. DC\_5\_n40: Added harmonic exception for bands 41 and 52 as they can be affected by third and fourth harmonic
7. DC\_5\_n78: Added harmonic exception for band 41 as it can be affected by scond harmonic (Harmonic exception is also defined in CA\_n5\_n78)
8. DC\_12\_n5: Added harmonic exception for bands 42 and 51 as they can be affected by second and fifth harmonic
9. DC\_20\_n8: Added harmonic exception for bands 3, 7, 22, 38, 42, 43 and n78 as they can be affected by second, third and fourth harmonic
10. DC\_20\_n28: Added harmonic exception as found for CA\_n20\_n28 which includes n78
11. DC\_26\_n77 & DC\_26\_n78 & DC\_26\_n79: Added harmonic exception for band 41 as it can be affected by thrid harmonic. Also added harmonic exception for fifth frequency range as it can be affected by thrid harmonic.
12. DC\_28\_n77: Added harmonic exception for bands 11, 21 and 74 as they can be affected by second and thrid harmonic
13. DC\_28\_n78: Added harmonic exception for bands 11 and 21 as they can be affected by second harmonic
14. DC\_28\_n79: Added harmonic exception for bands 11, 21 and 42 as they can be affected by second, third and fifth harmonic
15. DC\_66\_n71: Added harmonic exception for bands 7and 22 as they can be affected by second and fourth harmonic
 |
| [**R4-2110445**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110445.zip) | ZTE Corporation | Correct the ΔTIB,c description for FR1-FR2 inter-band CA combination. |
| R4-2109968 | Ericsson | Correction to band combinations for intra-band EN-DC (Rel-16) |

## Open issues summary

Sub-topic 6-1 is for discussing the issues about counter intermodulation raised by Softbank. The comments to other CRs should be made in 6.3.2.

### Sub-topic 6-1 Clarification of CIM

R4-2109155 questions the CRs previously agreed in RAN4#98. (R4-2003357/2095/2096).

**Issue 6-1: Clarification of CIM**

Please comment whether further clarification is needed as discussed by Softbank, i.e., whether the agreed CR should be checked again, or not.

* Proposals
* The definition of CIM5 should be clarified first of all.
	+ [Option-1] CIM5 appears on the other side of CIM3.
	+ [Option-2] CIM5 appears on the same side of CIM3.
	+ [Option-3] Other alternatives.
* Recommended WF
	+ Collect comments in the first round.

## Companies views’ collection for 1st round

### Open issues

Sub topic 6-1 Clarification of CIM

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Apple | Option-2: CIM5 appears on the same side of CIM3.We can call IM5 on the other side of CIM3. |
| Huawei | Thank Softbank for spotting this issue. It’s necessary to clarify the definition to align the understanding in RAN4. RAN4 may need further clarify which one is worse case. Is it the IM5/CIM5 on the same side of CIM3 or on the other side of CIM3? |
| Skyworks | The confusion on CIM3/5 is linked to whether we talk about the TRX impairment or the IMDs generated at the output of the PA. The TRX impairments with CIM3 (60dBc) and CIM5 (70dBc) are related to mixing products of harmonics of the LO and harmonics of the BB. This is a complex multiplication and thus at the input of the PA the CIM3 is on the opposite side to the wanted signal (small allocation on one edge of the channel) thus same side than image. CIM5 is then on the same side than wanted signal (opposite side from CIM3). This is the signal at the input of the PA for measurements or simulations. Now looking at the output of the PA due to non-linearities, the PA will generate IMD products from wanted and image which will be on both sides. IMD3 has one side that is fall on CIM3 and IMD5 that falls on CIM5. In the end MSD comes from both IMD products of wanted with image and CIM products. Hope it clarifies. |
| SoftBank-3 | Thanks for explanation. Then my question is, understanding that IMD for MSD is a mixture of IMD/CIM, whether we can live with the CR saying CIM5. As noted in my contribution, I will leave it up to vendor people who will add the relevant MSD. |
| Nokia | Issue 6-1: Clarification of CIM--> Option 1 |

For other contributions than CIM issues, comments should be provided in 6.3.2

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| [**R4-2108878**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2108878.zip) | Rohde & Schwarz: We need a revision for the CR. We missed to change the Note 1 in table 6.5B.3.3.2-1 in the same way as in the other tables. |
| [**R4-2109169**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109169.zip) |  |
| [**R4-2109455**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2109455.zip) | Apple: Uploaded revision. The revision does not anymore add harmonic exceptions (i.e. note 2) for all cases where notes 10 and 11 (also granting harmonic exception) are present. |
| [**R4-2110445**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110445.zip) |  |
| R4-2109968 | Huawei: It should follow the conclusion in subtopic 5-1. |

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

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

# Recommendations for Tdocs

## 1st round

**New tdocs**

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

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Notes:

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

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |

Notes:

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