**3GPP TSG-RAN WG4 Meeting # 96-e R4-200XXXX**

**Electronic Meeting, 17 – 28 Aug., 2020**

**Agenda item:** 4.2.3

**Source:** Moderator (Huawei)

**Title:** Email discussion summary for [96e][104] NR\_NewRAT\_UE\_RF\_Part\_3

**Document for:** Information

# Introduction

This email discussion handles the contributions submitted to agenda item 4.2.3, 4.2.3.1 and 4.2.3.3. The scope of this email discussion covers Rel-15 UE RF requirements maintenance on TS 38.101-3, which specifies the UE RF requirements for EN-DC operations. There are 3 topics (Rx, Tx and others) in this email discussion and multiple sub-topics within each of them. Note that since this discussion is mainly maintenance work we will start to agree on CRs and mirror CRs in the first round. In the second round only the contentious issues are discussed. There is no GTW time slot planned so far for this email discussion.

# Topic #1: Receiver requirements

Receiver requirements corrections are covered in Topic #1. Please see the below details. The moderator uses colours for mapping between papers/proposals and sub-topics.

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2009663 | Anritsu | Discussion paper on EN-DC OoBB UE power setup:  Observation 1: Multi-RAT DC UEs have multiple capabilities of operation modes. Thus we need to create a common test assumption also taking these factors and applicable absolute UL power into account as well as the combination of duplex modes.  Observation 2: It is preferred that TRx RF requirements are defined as general as possible irrespective of any UE operation modes, UE design and duplex modes.  **Proposal 1:** Apply PCMAX\_L,c – 4 dB as UL power level for the source of IMD unless the assumed absolute UL power is changed.  **Proposal 2:** Choose the UL power level whose DL is being tested taking into account of the balance between the analysis of 2nd or 3rd order IMD impact for 2UL/2DL configuration and the TE dynamic range. (i.e. In between PCMAX\_L,c – 14 dB and PCMAX\_L,c – 29 dB.) |
| R4-2010045 | Apple | Discussion paper on EN-DC OoBB UE power setup:  Observation 1: OBB UL test configuration is generic to all EN-DC combinations irrespective of whether MSD is required and the MSD level. The UL power setting should be determined based on the worst-case MSD among all EN-DC combinations.  **Proposal:** Use (PCMAX\_L – 4dB, PCMAX\_L – 32dB) as the UL configuration for EN-DC OBB requirements.  Observation 2: The UL configuration for E-UTRA and NR 2UL inter-band CA OBB requirements as currently defined with both UL output power set to 7 dB below PCMAX\_L,f,c for each serving cell c is only applicable to CA combinations which do not have 2UL IMD issue or the IMD does not overlap with any DL carrier under the specified test configurations. |
| R4-2010046 | Apple | CR implementing R4-2010045 proposal for both EN-DC and NE-DC:  Change UL power setting for the lower UL power carrier (either E-UTRA or NR) from minimum output power to 32 dB below PCMAX\_L |
| R4-2010047 | Apple | Mirror CR to R4-2010046 |
| R4-2010320 | NTT DOCOMO | Discussion paper on EN-DC OoBB UE power setup:  Observation 1: Motivation on testing OoBB for inter-band EN-DC is to confirm Rx performance under IM caused by OoBB interfere and UL of the band being not tested, which cannot be confirmed in SA specification.  Observation 2: Same level of Rx performance with LTE CA should be expected in EN-DC mode.  Observation 3: Rx performance of LTE 2UL/2DL CA is confirmed with the condition of Pcmax -7dB for dual UL as LTE 2UL/2DL test case and the condition of Pcmax-4dB for single UL as LTE 1UL/2DL test case (which is tested in fallback combination of 1UL/2DL).  Observation 4: Considering the motivation on OoBB in inter-band EN-DC, the UL transmission power setting of Pcmax -4dB for the band whose DL being not tested should be kept.  Observation 5: Considering the testability issue and impact on already implemented devices, changing the UL transmission power setting as Pcmax –[14-29]dB for the band whose DL being tested should be considered.  **Proposal:** For OoBB for inter-band EN-DC within FR1 with 1 LTE band + 1 NR band, the UL transmission power of bands should be modified as Pcmax -4dB for the band whose DL being not tested and Pcmax –[14-29] dB for the band being tested. |
| R4-2009623 | Qualcomm | CR:  Cross band noise MSD must be added to the following interband ENDC band combinations: DC\_1A\_n40A is missing MSD = 21.5dB for n40 UL BW = 80MHz due to 5th order distortion |
| R4-2009624 | Qualcomm | Mirror CR to R4-2009623 |
| R4-2009625 | Qualcomm | CR:  IMD MSD must be added to the following interband ENDC band combinations: DC\_1A-41A\_n78A is missing IMD4 MSD = 8.7dB for victim B1 like DC\_1A-7A\_n78A; DC\_7A-28A\_n78A needs IMD2 MSD = 28.8dB for victim B28 like DC\_7A\_n28A-n78A, IMD2 MSD needs to increase from 8.3dB to 28.8dB |
| R4-2009626 | Qualcomm | Mirror CR to R4-2009626 |
| R4-2009664 | Anritsu | CR for EN-DC UE REFSENS exceptions:  Added Note so that the value of Minimum requirement can be extended and interpreted to other SCS and BW.  Maintenance: Added SCS of UL band for each band in Table 7.3B.2.3.1-2. |
| R4-2009665 | Anritsu | Mirror CR to R4-2009664 |
| R4-2010020 | Xiaomi | Maintenance CR:  Adding the Uplink configurations for DC\_5-n78  Revising the note13 in table 7.3B.2.3.1-1 to add ∆FHD for DC\_28\_n51 and DC\_66\_n78 |
| R4-2010021 | Xiaomi | Mirror CR to R4-2010020 |
| R4-2010794 | Rohde & Schwarz | Maintenance CR:  Add missing n78 to the bands with MSD |
| R4-2010795 | Rohde & Schwarz | Mirror CR to R4-2010794 |
| R4-2011460 | Skyworks | Moved to topic #3 |
| R4-2009964 | Apple | Maintenance CR:  UL harmonics: Additions for Table 7.3B.2.3.1-1 and Table 7.3B.2.3.1-2  IMD: Table 7.3B.2.3.5.1-1 and Table 7.3B.2.3.5.2-1 |
| R4-2009965 | Apple | Mirror CR to R4-2009964 |

## Open issues summary

5 sub-topics are listed in the below sections. In sub-topic 1-5, the moderator recommends the maintenance/editorial changes (without technical contention) should be merged into one CR.

### Sub-topic 1-1

3 discussion papers were submitted to discuss the UL UE power setups for EN-DC OoBB tests. The main controversy is how much UL power value should be set for the UL band that is being tested. CRs from Apple try to implement their proposals.

**Issue 1-1: how much UL UE power is to be set?**

* How much UL UE power is to be set for the UL band being tested?
  + Option 1: In between PCMAX\_L,c – 14 dB and PCMAX\_L,c – 29 dB
  + Option 2: PCMAX\_L,c – 32 dB
  + Option 3: other value
* Apply PCMAX\_L,c – 4 dB to UL power level for the source of IMD
  + Option 1: Yes
* Recommended WF
  + Agree on PCMAX\_L,c – 4 dB for source of IMD power and discuss to converge on power seting for UL bands being tested.

### Sub-topic 1-2

Band n40 has UE channel BW up to 80MHz. when operating under 80MHz UE channel bandwidth, a separate MSD REFSENS requirement due to cross band isolation is proposed by company that 21.5dB MSD is needed for DC\_1A\_n40A.

**Issue 1-2: additional cross band isolation MSD is needed for DC\_1A\_n40A**

* 21.5dB MSD is specified for UE under CW 80MHz DC\_1A\_n40A
  + Option 1: Yes
  + Option 2: No
  + Option 3: other value
* Recommended WF
  + Agree on the CR and mirror CR to specify the additional cross band isolation MSD for DC\_1A\_n40A if no objection is observed

### Sub-topic 1-3

Problems identified:

* DC\_1A-41A\_n78A is missing IMD4 MSD by DC\_41A\_n78A to band 1
* 8.3dB MSD due to IMD2 from DC\_7\_n78 to band 28 is not enough

**Issue 1-3: add 8.7dB MSD for DC\_1A-41A\_n78A; increase 8.3dB to 28.8dB MSD for DC\_7A-28A\_n78A**

* Add 8.7dB MSD for DC\_1A-41A\_n78A
  + Option 1: Yes
  + Option 2: No
* Increase 8.3dB to 28.8dB MSD for DC\_7A-28A\_n78A
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + Agree on the CR and mirror CR if no objection is observed

### Sub-topic 1-4

Problems identified:

* Other SCS-s/BW-s are not defined for EN-DC UE REFSENS than the ones in the tables in 7.3B.2.3
* UL SCS is missing in table 7.3B.2.3.1-2

**Issue 1-4: add note to clarify that for other SCS-s/BW-s the test is also carried out**

* Add notes in MSD tables that: *MSD test points can be chosen according to UE supported BW and SCS*
  + Option 1: Yes
  + Option 2: No
* Add notes in UL configuration tables to clarify that: *if the aggressor band is NR band, the test SCS and UL RB can be adjusted according to UE supported BW and SCS*
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + Agree on at least the addition of UL SCS to table 7.3B.2.3.1-2; consider to agree on other parts

### Sub-topic 1-5

REFSENS Maintenance works:

* Note 13 in table 7.3B.2.3.1-1 misses band combinations 10020
* Table 7.3B.2.3.1-2 misses UL SCS-s 09664
* Add missing n78 as an affected band for MSD in DC\_1A\_n78A in table 7.3B.2.3.5.1-1 10794
* Add n78 into n77 boxes of UL harmonics and IMD; add missing MSD requirements due to IMDs 09964

Technical comments on the maintenance CRs are also welcomed in the comment boxes either for sub-topic 1-5 or for the individual CR in section 1.3.2.

**Issue 1-5: REFSENS maintenance works**

* Merge all the REFSENS maintenance works in one CR
  + Option 1: Yes, revise one CR to capture the agreeable parts in each CR
  + Option 2: No, revise every CR that needs to be revised
* If one CR approach is to be used, which CR is to be the baseline?
  + Option 1: R4-2010020 Xiaomi
  + Option 2: R4-2009664 Anritsu
  + Option 3: R4-2010794 R&S
  + Option 4: R4-2009964 Apple
* Recommended WF
  + Agree on one maintenance CR for REFSENS requirements

## Companies views’ collection for 1st round

### Open issues

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| **Sub-topics** | **Comments** |
| Issue 1-1:  how much UL UE power is to be set? | Ericsson: we have not followed this, but why should one of the ULs be reduced by up to 32 dB for *all* EN-DC combinations even if there is no IMD2/3 exception for REFSENS? If an IMD2/3 exception, then it is a spurious response but with some IMD products always within the measured DL. One alternative option could be:  Option 3: keep the 7 dB offset for combinations without IMD2/3 in the DL. If an allowed IMD2/3 exception in the REFSENS test, reduce the UL power on the measured band by 29/32 dB relative to Pcmax. This should not affect the number of allowed spurious responses.  NTT DOCOMO, INC:  **Issue 1-1: how much UL UE power is to be set?**  **How much UL UE power is to be set for the UL band being tested?**  We are OK with Both option 1 and 2  **Apply PCMAX\_L,c – 4 dB to UL power level for the source of IMD**  Option 1.  Anritsu: By an actual experiment, we confirmed that Option 2: PCMAX\_L,c – 32 dB is still testable though the proposed level is closer to the theoretical limit than we showed our compromise as Pcmax\_l,c – 29dB. Therefore either Option 1 or 2 is fine for us if we can make a progress with this topic.  Qualcomm: In order to test impact of IMD between OOB and the aggressor UL (LTE UL if NR is being tested and NR UL if LTE is being tested), the aggressor UL power level should be set to Pcmax – 4dB. On the other hand, Apple’s analysis is also valid. If the goal is testing the impact of IMD between OOB and the aggressor UL, then the impact of IMD between the two UL should be avoided. This can only happen if one of the victim UL is reduced to the point that the undesired IMD falls below thermal. I don’t think we need 32dB, but something in that ballpark seems reasonable. This should meet both testability as well as test requirement challenges.  Apple: Option 2: PCMAX\_L,c – 32 dB  We performed the IMD analysis and realized that to avoid the impact from 2UL IMD to OBB test results, one of the UL power needs to be lower than PCMAX\_L,c – 32 dB when the other UL is maintained at PCMAX\_L,c – 4 dB. |
| Issue 1-2:  additional cross band isolation MSD is needed for DC\_1A\_n40A | CHTTL: please see my comment for the R4-2009623 below.  Huawei:  The cross check is needed to further evaluate the numbers. Can we come up with a general method to distinguish UL BW instead of adding a note? For DC\_1\_n40, the UL configuration for band n40 should be evaluated to support 80MHz. In current spec, the SCS of UL is 15 kHz. |
| Issue 1-3:  add 8.7dB MSD for DC\_1A-41A\_n78A; increase 8.3dB to 28.8dB MSD for DC\_7A-28A\_n78A |  |
| Issue 1-4:  add note to clarify that for other SCS-s/BW-s the test is also carried out | Qualcomm: Option 2  Notes are not required in the tables because the SCS is already specified in the UL configuration table. The only requirement is for that specific SCS.  Also, no need to add the note in the MSD tables to indicate which band is the aggressor. The UL band is always the aggressor.  Also, no need to change the table because it is not likely to have higher SCS for LB/MB as the aggressor for UL harmonic. Adding column in UL config as suggested is required in harmonic table only if there is possibility that UL config will use higher SCS, otherwise a simple note is ok for this specific case is required. So, this modification can be handled on a case x case basis.  Anritsu: Thanks for the comment. Then the question would be how we can treat the UEs which do not support the defined SCS and CBW. At first can we confirm in RAN4 if all the corresponding CBW and SCS depending on the supported band for example described in TS 38.101-1 Table 5.3.5-1 shall be supported by UE? If so, how can we decide the verdict of the UEs if they do not support the corresponding SCS or CBW? Can we conclude the test results as inconclusive or Fail?  Apple: The MSD test point is discussed based on a specific supported BW and SCS. We would like to ask Anritsu to please clarify if they have an MSD issue with a specific combination. |
| Issue 1-5:  REFSENS maintenance works | Qualcomm: Support adding missing n78. |
| Others: |  |

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| R4-2010046  R4-2010047 |  |
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| R4-2009623  R4-2009624 | CHTTL: the new MSD is defined for UL = 80MHz with a NOTE, but the UL configuration is set 25/50/75/100 RB with 15kHz SCS only, I guess the UL configuration table might need to be revised. |
| Huawei: For DC\_1\_n40, the UL configuration for band n40 should be evaluated to support 80MHz. In current spec, the SCS of UL is 15 kHz. |
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| R4-2009625  R4-2009626 | Huawei: The test frequency point for band 1 is not correct. |
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| R4-2009664  R4-2009665 | CHTTL: Sorry for the late question, just wonder whether the MSD with N/A will be update in the future? (or it is case by case), if my memory is correct, some of the combos were requested not to define the MSD for the IMD due to some reason, in this case we just keep N/A in the spec? |
| Huawei: In Table 7.3B.2.3.2-2, 7.3B.2.3.4-2 and 7.3B.2.3.1-2, there is no need to add superscript for aggressor NR bands one by one. |
| Qualcomm: Cannot agree to CR |
| R4-2010020  R4-2010021 |  |
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| R4-2010794  R4-2010795 | Apple: The missing n78 was already included in our agreed CR (R4-2008413) from last meeting. We had a re-submission to correct the Table format this meeting. (R4-2009964). |
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| R4-2009964  R4-2009965 |  |
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## 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.*

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|  | **Status summary** |
| **Sub-topic#1-1** | *Tentative agreements:*  Agree on PCMAX\_L,c – 4 dB for source of IMD power.  *Candidate options:*  Option 1: In between PCMAX\_L,c – 14 dB and PCMAX\_L,c – 29 dB  Option 2: PCMAX\_L,c – 32 dB  Option 3: keep the 7 dB offset for combinations without IMD2/3 in the DL. If an allowed IMD2/3 exception in the REFSENS test, reduce the UL power on the measured band by 29/32 dB relative to Pcmax. This should not affect the number of allowed spurious responses  *Recommendations for 2nd round:*  Further discuss to converge on power setting for UL bands being tested in the 2nd round. The moderator recommends we also consider option 3 in addition to option 1/2 as a possible WF. |
| **Sub-topic#1-2** | *Tentative agreements:* .  *Candidate options:* NA  *Recommendations for 2nd round:*  Discuss further on how to revise the UL configuration table to accommodate 30KHz SCS 80MHz UE bandwidth. |
| **Sub-topic#1-3** | *Tentative agreements:*  *Candidate options:* NA  *Recommendations for 2nd round:*  Revise the CR to correct test point for band 1.Agree on the revised CR and close the sub-topic. |
| **Sub-topic#1-4** | *Tentative agreements:* .  *Candidate options:* NA  *Recommendations for 2nd round:*  Continue discussion. |
| **Sub-topic#1-5** | *Tentative agreements:*  all the REFSENS maintenance corrections seem agreeable.  *Candidate options:*  *Recommendations for 2nd round:*  The moderator recommends R4-2009964 be revised to capture all the REFSENS maintenance corrections. Other CRs are *Merged.* |

*Recommendations on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2010046  R4-2010047 | Continue discussion |
| R4-2009623  R4-2009624 | Revise the CR |
| R4-2009625  R4-2009626 | Revise the CR |
| R4-2009664  R4-2009665 | Continue discussion |
| R4-2010020  R4-2010021 | Merge into revised R4-2009964 |
| R4-2010794  R4-2010795 | Merge into revised R4-2009964 |
| R4-2009964  R4-2009965 | Revise the CR |

## Discussion on 2nd round

**Issue 1-1: how much UL UE power is to be set?**

* How much UL UE power is to be set for the UL band being tested?
  + Option 1: In between PCMAX\_L,c – 14 dB and PCMAX\_L,c – 29 dB
  + Option 2: PCMAX\_L,c – 32 dB
  + Option 3: keep the 7 dB offset for combinations without IMD2/3 in the DL. If an allowed IMD2/3 exception in the REFSENS test, reduce the UL power on the measured band by 29/32 dB relative to Pcmax. This should not affect the number of allowed spurious responses

**Issue 1-2: additional cross band isolation MSD is needed for DC\_1A\_n40A**

* Discuss further on how to revise the UL configuration table to accommodate 30KHz SCS 80MHz UE bandwidth
* 21.5dB MSD is specified for UE under CW 80MHz DC\_1A\_n40A
  + Option 1: Yes
  + Option 2: No
  + Option 3: other value

**Issue 1-4: add note to clarify that for other SCS-s/BW-s the test is also carried out**

* Add notes in MSD tables that: *MSD test points can be chosen according to UE supported BW and SCS*
  + Option 1: Yes
  + Option 2: No
* Add notes in UL configuration tables to clarify that: *if the aggressor band is NR band, the test SCS and UL RB can be adjusted according to UE supported BW and SCS*
  + Option 1: Yes
  + Option 2: No

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| **Sub-topics** | **Comments** |
| Issue 1-1:  how much UL UE power is to be set? | Qualcomm: We missed a key sentence that should have been added to our 1st round comment:  However, what seems to be missing from this analysis is the fact that any sensitivity degradation due to IMD or UL harmonics is already accounted for through MSD table. For OOB tests, DL power level is set to SC Reference Sensitivity + MSD + OOB Offset Value. So in reality, Pcmax – 7 should work very well for both UL carriers.  Apple: We prefer not to have multiple test configurations which depend on whether the combination is subject to IMD2/IMD3 as in newly proposed option 3. Notice that the goal for this test is rather clear that for EN-DC, we would not be able to test standalone NR OOB without LTE as anchor. Therefore, the test environment is set up to mimic NR single band OOB test, where the other UL power is maintained low enough for not impacting the OOB test results, yet is testable for EN-DC operation by TE. Since in 1st round discussions, Anritsu has already confirmed that option 2 is feasible and we do not see objection from other companies, we suggest to move forward with option 2 to close this issue.  To Qualcomm’s comments, the purpose for this change is to enable the testability for TE to mimic NR single band OOB test under EN-DC operation, but not to test OOB under 2UL. We understand that if a combination is subject to MSD, the wanted signal can be further increased by MSD amount. However, we are not sure if the OOB test would use the same test configuration for MSD. And the MSD defined for 2UL only represents one particular test configuration. There are many other configurations which MSD has not been evaluated. In our view, testing OOB under the MSD test configurations would not be so meaningful as the results are very much obscured by the MSD, especially when MSD is relatively large. By the way, 2UL MSD has been defined at PCMAX\_L - 3dB, not at PCMAX\_L -7dB. |
| Issue 1-2:  additional cross band isolation MSD is needed for DC\_1A\_n40A | Qualcomm: We have a WF in thread 121 that addresses this band combination as well. We agree to thr required UL configuration change for 80MHz.  [WF on handling new channel BW’s for EN-DC and NR CA band combinations with MSD](ftp://ftp.3gpp.org/tsg_ran/WG4_Radio/TSGR4_96_e/Inbox/Drafts/%5B121%5D NR_R16_Maintenance/draftv2_R4-2011777_WF on handling new channel BW%92s for EN-DC and NR CA band combinations with MSD.pptx)  CR revision here:  [CBN\_DC\_1\_n40\_MSD](ftp://ftp.3gpp.org/tsg_ran/WG4_Radio/TSGR4_96_e/Inbox/Drafts/%5B104%5D NR_NewRAT_UE_RF_Part_3/draft_R4-2011756_CR_CatF_Rel15_missing_CBN_DC_1_n40_MSD.docx)  UL configuration:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **E-UTRA or NR Band / SCS / Channel bandwidth of the affected DL band / UL RB allocation of the agressor band** | | | | | | | | **UL band** | **DL band** | **SCS of UL band (kHz)** | **5 MHz**  **(LCRB)** | **10 MHz**  **(LCRB)** | **15 MHz**  **(LCRB)** | **20 MHz**  **(LCRB)** | | n403 | 1 | 30 |  | [50] | [50] | [50] | | NOTE 3: Applicable only for n40 UL BW = 80MHz. | | | | | | |     Xiaomi: We think the UL configuration of band n40 when testing 5MHz DL of band 1 should be specified as well in above table, since you have provided MSD value for 5MHz in MSD table, otherwise the MSD requirement for 5MHz is incomplete.  Qualcomm: there is already another row that is for the UL BWs not equal to 80MHz that uses UL for 15KHz SCS. This is in the CR. Anyway, this CR will not be pursued, as there is a WF to handle this. The updated WF is here:  <ftp://ftp.3gpp.org/tsg_ran/WG4_Radio/TSGR4_96_e/Inbox/Drafts/%5B121%5D%20NR_R16_Maintenance/draftv7_R4-2011777_WF%20on%20handling%20new%20channel%20BW%20for%20EN-DC%20and%20NR%20CA%20band%20combinations.pptx> |
| * Issue 1-3: DC\_1A-41A\_n78A is missing IMD4 MSD by DC\_41A\_n78A to band 1 | Qualcomm: Test frequencies in Band 1 are correct as follows:    Updated draft for CR:  [DC\_1A-41A\_n78A is missing IMD4 MSD by DC\_41A\_n78A to band 1](ftp://ftp.3gpp.org/tsg_ran/WG4_Radio/TSGR4_96_e/Inbox/Drafts/%5B104%5D NR_NewRAT_UE_RF_Part_3/draft_R4-2011757_CR_CatF_Rel15_missing_IMD_MSD.docx) |
| Issue 1-4:  add note to clarify that for other SCS-s/BW-s the test is also carried out | Qualcomm: We recognize the need to have clarification for the supported SCS in the UE. So, we support the CR from this aspect. We can support this CR provided there is consensus from other companies for other issues in CR.  Anritsu: To reply to the comment from Apple at the 1st round below.  Apple: The MSD test point is discussed based on a specific supported BW and SCS. We would like to ask Anritsu to please clarify if they have an MSD issue with a specific combination.  Anritsu reply :No, we do not have an MSD issue. We wanted to add the Note 14 since we observed UEs which do not support some CBW and SCS which are required to be tested in the REFSENS exceptions.  To reply to Huawei ‘s comment at the 1st round below.  Huawei: In Table 7.3B.2.3.2-2, 7.3B.2.3.4-2 and 7.3B.2.3.1-2, there is no need to add superscript for aggressor NR bands one by one.  Anritsu reply: OK. I understood.  By all discussions above, we suppose that the contents of the CR R4-2009664 became agreeable except for the points indicated by Huawei above.  So remaining changes in 9664 will be merged to R4-2011760 (revision from 9964).  Apple: We are ok to add the note to clarify the test, however we think that additional wording is required. Since the UE can support multiple SCS for a specific BW, we have included in the note that the lowest SCS supported by the UE applies. We have revised the draft CR (R4-2011760) and shared it in the reflector. |
| Others: |  |

## Summary on 2nd round

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| R4-2010046  R4-2010047 | Postponed;  ACR withdrawn |
| R4-2011756  R4-2009624 | Not pursued;  ACR withdrawn |
| R4-2011757  R4-2009626 | Agreed |
| R4-2009664  R4-2009665 | Merged into R4-2011760;  ACR withdrawn |
| R4-2011760  R4-2009965 | Agreed |

# Topic #2: Transmitter requirements

Transmitter requirements corrections are covered in Topic #2. Please see the below details. The moderator uses colours for mapping between papers/proposals and sub-topics.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2010598 | Ericsson | CR to remove Rel-15 allowance for UE to either implement PC2 or PC3 in EN-DC when the UE reports being capable of 2ports SRS in SA:  The power-class ambiguity for a UE indicating NR PC2 and supporting two SRS ports in SA but only one SRS port in NSA is removed. |
| R4-2010123 | SoftBank, NTT DOCOMO, KDDI | CR for Japan:  1) Protections among n5, B74, n77 - n79 are added.  2) Note 13(B3 frequency range), Note 15(NS\_05), Note 19(B41 frequency range) are deleted as protected bands are not relevant to specific CBWs or the requirements are not subject to A-MPR.  3) Japan-related requirements are removed from B38, B40 and B5(which is limited to NB/MTC in Note 4.) Note 4 is also deleted.  4) Some errors are corrected: The contents of Note 10/11 are corrected to align with those of 36.101. |
| R4-2010124 | SoftBank, NTT DOCOMO, KDDI | Mirror CR to R4-2010123. |
| R4-2010921 | Huawei, HiSilicon | Spurious CR:  1. PHS system protection is removed for DC\_1\_n28.  2. Some bands which need harmonic exception are added.  3. EN-DC configuration is replaced by EN-DC band combination |
| R4-2010922 | Huawei, HiSilicon | Mirror CR to R4-2010922. |
| R4-2009661 | Anritsu | Maintenance CR:  Correct the reference number for SCG from TS 36.101 to TS 38.101-1. Also the corresponding clause is changed. |
| R4-2009662 | Anritsu | Mirror CR to R4-2009661. |
| R4-2009975 | KDDI | Maintenance CR:  Correct protected band of band 41/n41 intra-band EN-DC. The requirements follow those of band n41 in TS 38.101-1. |

## Open issues summary

### Sub-topic 2-1

R4-2010598 proposes to delete descriptions in clause 6.1: ~~Unless otherwise stated, if UE indicates IE maxNumberSRS-Ports-PerResource = n2 in NR standalone operation mode, the said UE shall meet the NR requirements for either power class 2 or power class 3 in EN-DC within FR1 if UE indicates IE maxNumberSRS-Ports-PerResource = n1 for EN-DC on this NR band.~~

**Issue 2-1: remove the above descriptions to refrain the UE from implementing either PC2 or PC3 in EN-DC when the UE reports 2ports SRS capability in SA.**

* Proposals
  + Option 1: Yes, remove allowance.
  + Option 2: No, leave it to UE implementation.
* Recommended WF
  + Needs more discussion on the matter.

### Sub-topic 2-2

CR for Japan.

**Issue 2-2: whether to agree on R4-2010123 and its mirror CR for Japan?**

* Proposals
  + Option 1: Yes
* Recommended WF
  + Agree on the CRs to implement Changes proposed by operators in Japan if no objection is observed.

### Sub-topic 2-3

Spurious CR.

**Issue 2-3: whether to agree on R4-2010921 and its mirror CR?**

* Remove PHS protection requirements for DC\_1\_n28
  + Option 1: Yes
  + Option 2: No
* Correct EN-DC configuration with EN-DC band combination
  + Option 1: Yes
  + Option 2: No
* Other changes
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + Agree on the CRs if no objection.

### Sub-topic 2-4

Maintenance CRs. Technical comments on the maintenance CRs are also welcomed in the comment boxes either for sub-topic 2-4 or for the individual CR in section 2.3.2.

**Issue 2-4: whether to agree on the maintenance CRs?**

* Agree on R4-2009661 and mirror CR
  + Option 1: Yes
* Agree on R4-2009975
  + Option 1: Yes
* Recommended WF
  + Agree on the CRs.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Sub-topics** | **Comments** |
| Issue 2-1:  remove the descriptions to refrain the UE from implementing either PC2 or PC3 in EN-DC when the UE reports 2ports SRS capability in SA | vivo: Option 2. The discussion has been extended for several meetings, and views remain divided. Currently related discussion is still on going in Email thread [120]. No agreement seems possible before a complete package can be reached.  OPPO: Option 2, our suggestion is that for Rel-15 keep as it is and focus on Rel-16 discussion.  Ericsson: Option 1. Note that this is part of the package proposed for NSA in R4-2010599 (Draft Reply LS to RAN5) and discussed in [120]  Huawei: Option 2, keep the clarification in Rel-15 as it is. Relevant discussion is carried out under thread [120] and we need to wait for the discussion conclusion in that thread.  Qualcomm: Support removal of the ambiguity since even the text the way it is written is causing confusion. Support this Ericsson CR. |
| Issue 2-2:  whether to agree on R4-2010123 and its mirror CR for Japan |  |
| Issue 2-3:  whether to agree on R4-2010921 and its mirror CR | [SoftBank] We believe CRs for sub topic 2-2 cover DC\_1-n28 so merge the CRs into 10123/mirror upon agreement of the proponents.  Nokia: EN-DC configuration is correct term, do not change to band combination  Huawei: To Softbank, fine to merge this CR into yours. |
| Issue 2-4:  whether to agree on the maintenance CRs |  |
| Others: |  |

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2010598 | vivo: Currently disagree. This CR has been debated for several meetings and views are remain divided. Currently related discussion is still on going in Email thread [120]. No agreement seems possible for this CR before a complete package can be reached. Propose not to treat this CR before that. |
| Ericsson: note that this is part of the package proposed in R4-2010599 in [120]. |
|  |
| R4-2010123  R4-2010124 | Huawei: Some harmonic interference bands are missing for DC\_1\_n28. |
|  |
|  |
| R4-2010921  R4-2010922 | [SoftBank] Consider to merge with 10123(above.) |
| Huawei: To Softbank, I’m fine to merge this CR into yours. |
|  |
| R4-2009661  R4-2009662 |  |
|  |
|  |
| R4-2009975 |  |
|  |
|  |

## 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#2-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  Continue discussion |
| **Sub-topic#2-2** | *Tentative agreements:*  The contents of the CRs are agreeable.  *Candidate options:*  *Recommendations for 2nd round:*  Revise the CR to capture agreeable contents in R4-2010921. |
| **Sub-topic#2-3** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  Continue discussion and merge agreeable contents into R4-2010123 |
| **Sub-topic#2-4** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  Agree on all the CRs. |

*Suggestion on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### 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** |
| R4-2010598 | Continue discussion |
| R4-2010123  R4-2010124 | Revise the CR. |
| R4-2010921  R4-2010922 | Merged |
| R4-2009661  R4-2009662 | Agreeable |
| R4-2009975 | Agreeable |

## Discussion on 2nd round

**Issue 2-1: remove the above descriptions to refrain the UE from implementing either PC2 or PC3 in EN-DC when the UE reports 2ports SRS capability in SA.**

* Proposals
  + Option 1: Yes, remove allowance.
  + Option 2: No, leave it to UE implementation.

**Issue 2-3: whether to**

* Correct EN-DC configuration with EN-DC band combination
  + Option 1: Yes
  + Option 2: No
* Other changes
  + Option 1: Yes
  + Option 2: No

|  |  |
| --- | --- |
| **Sub-topics** | **Comments** |
| Issue 2-1:  remove the descriptions to refrain the UE from implementing either PC2 or PC3 in EN-DC when the UE reports 2ports SRS capability in SA | vivo: Option 2. As stated in the 1st round, no conclusion for CR could be made before a package could be agreed.  Qualcomm: This is not exactly same topic as in thread 120, this CR tries to correct an ambiguous spec since there are two interpretations of the language. Our view is that there is no relaxation and never was. Not sure what is the purpose of this text and even GCF finds it confusing so we should correct the spec.  OPPO: Option2. |
| Issue 2-3:  whether to correct EN-DC configuration with EN-DC band combination | Nokia: Option 2, EN-DC band combination is not correct term. |
| Others: |  |

## Summary on 2nd round

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| R4-2010598 | Postponed |
| R4-2011759  R4-2010124 | Agreed |
|  |  |

# Topic #3: EN-DC configuration

Several other issues are covered in Topic #3. Please see the below details. The moderator uses colours for mapping between papers/proposals and sub-topics.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2009964 | Apple | Moved to Topic #1. |
| R4-2009965 | Apple | Moved to Topic #1. |
| R4-2010825 | Huawei, HiSilicon | EN-DC configurations:  Add a new NOTE for DC\_20\_n28 to avoid the unnecessry performance degradation under inappropriate scenario which cannot meet conditions in Note 10 and Note 11. |
| R4-2010826 | Huawei, HiSilicon | Mirror CR to R4-2010825 |
| R4-2011460 | Skyworks | DC\_42\_n79 CR:  Add Note 3 to DC\_42\_n79  Mirror part for Rel-16 is in R4-2011515, thread 121. |

## Open issues summary

### Sub-topic 3-1

In the EN-DC configuration table, the statement (note 10 and note 11) specifies some conditions for UE to meet corresponding EN-DC requirements. However, such conditions can only be met under co-located deployment scenario. To make it clear that performance may not be guaranteed under inappropriate scenario, an additional Note is added for clarification.

**Issue 3-1: Further clarify on the co-located scenario for DC\_20\_n28.**

* Add a note 12 to clarify that note 10 and note 11 mean co-located deployment
  + Option 1: Yes, it needs further clarification.
  + Option 2: No need to have a new note.
* Recommended WF
  + Needs more discussion on the matter.

### Sub-topic 3-2

Wether DC\_42\_n79 supports simultaneous Tx/Rx is ambiguous, it cannot be supported by solutions implemented with n77 or n78 filter without MSD as already shown for CA\_n79-n79.

**Issue 3-2: whether to add note 3 to DC\_42\_n79?**

* Add note 3 to DC\_42\_n79 in the configuration table
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + If the CR is agreeable, endorse it and merge. Or we agree on the CR and ask for a new mirror CR number for Rel-16.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Sub-topics** | **Comments** |
| Issue 3-1:  Further clarify on the co-located scenario for DC\_20\_n28 | Qualcomm: No need to add a new note. Notes 10 and 11 are sufficient and Note 12 is not required. Co-location/non-colocation need not be discussed in the specification.  Huawei: What’s the assumption of the deployment scenario by Qualcomm for Note 10 and Note 11? Is it possible for the UE works well under non-collocated scenario? If yes, how the network can guarantee the PSD difference as well as sync condition? If not, what’s the reason Qualcomm objects the clarification in the spec?…. |
| Issue 3-2:  whether to add note 3 to DC\_42\_n79 | NTT DOCOMO, INC:  We would like to enable simultaneous Rx/Tx capability for B42\_n79 by allowing MSD as same with n78-n79 with an assumption of n78 filter implementation.  Qualcomm: We can support option 1. |
| Others: |  |

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2010825  R4-2010826 | Nokia: This CR was alredy presented in last meeting and then it was commented by us that we do not specify network behavior in UE Spec. |
| Huawei: The note has been changed compared to the one in last meeting based on Nokia’s comments. It is not to specify the network behavior, more like a clarification. Network should be more cautious about Note 10 and Note 11 instead, those are actually the limitations for network behavior, as PSD difference as well as sync condition relies on network to guarantee.  On the other hand, we disagree the comment that UE spec does not specify anything related to network behavior, for instance, maximum UL dutycycle, single UL allowed… |
| Qualcomm: We cannot agree to CR.  Huawei: We’d like to see the clarification from QC for the specific reason not to agree the CR. |
| Apple: For the correct implementation of mirror CR we would like to highlight that the NOTE numbering is different in the specification of Rel-15 to the Rel-16. |
| R4-2011460 | NTT DOCOMO, INC:  We would like to enable simultaneous Rx/Tx capability for B42\_n79 by allowing MSD as same with n78-n79 with an assumption of n78 filter implementation. |
| Qualcomm: Agree to CR and ask for mirror |
|  |

## 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#3-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  Continue discussion.  The moderator recommends the proponent should come up with compromised wording just to clarify existing notes instead of to add a new one. |
| **Sub-topic#3-2** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  Continue discussion on how to address the operator’s concern. |

*Suggestion on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### 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** |
| R4-2010825  R4-2010826 | Continue discussion. |
| R4-2011460 | Continue discussion. |

## Discussion on 2nd round

**Issue 3-1: Further clarify on the co-located scenario for DC\_20\_n28.**

* Add a note 12 to clarify that note 10 and note 11 mean co-located deployment
  + Option 1: Yes, it needs further clarification.
  + Option 2: No need to have a new note.

The moderator recommends the proponent should come up with compromised wording just to clarify existing notes instead of to add a new one.

**Issue 3-2: whether to add note 3 to DC\_42\_n79?**

* Add note 3 to DC\_42\_n79 in the configuration table
  + Option 1: Yes
  + Option 2: No

The discussion should focus on how to address the operator’s concern.

|  |  |
| --- | --- |
| **Sub-topics** | **Comments** |
| Issue 3-1:  Further clarify on the co-located scenario for DC\_20\_n28 | Qualcomm: Prefer Option 2. Yes, notes 10 and 11 could easily imply colocation. However, you can ask the same question, why does intra-band ENDC not require a note stating that gNB and eNB must be collocated? Maybe this is specified in the baseband spec. We only specify the quantitative conditions for which the RF requirements must be met. We should get consensus from the group or operators as to whether there is a need to have additional clarification for this band combination.  Moderator: can we proceed with not adding a new note but modifying note 11 as below?  *NOTE 11:             The minimum requirements apply for synchronized DL carriers with a maximum receive time difference ≤ 3 usec (co-location deployment). The requirements also apply for these carriers when applicable EN-DC configuration is a subset of a higher order EN-DC configuration*  Qualcomm: We are still of the opinion that explicit clarification is not required besides note 10 and 11 without modification. Huawei is welcome to source other opinions as well. In LTE, band 7 and band 38 did not explicitly mention colocation, but it may have been assumed.  Nokia: Option 2 |
| Issue 3-2:  whether to add note 3 to DC\_42\_n79 | Qualcomm: Option 1.  Skyworks: we believe there may be different solutions for R15 and R16  For R15: add Note 3 or add note “Simultaneous Rx/Tx capability does not apply for UEs supporting band 42 with a n77 implementation.”, and not adding MSD (only UEs with B42 filter and separate antenna for n79 may meet the requirement).  For R16: add note “Simultaneous Rx/Tx capability does not apply for UEs supporting band 42 with a n77 implementation.” And add MSD based on NR CA\_n78-n79  To moderator: depending on outcome I may need a revision for R15 and a Tdoc number for R16 CR  Moderator: is it acceptable for DOCOMO? a question: how does the network behave in response to R15 and R16 UEs respectively? I assume that with the note added R15 UE also indicates support for DC\_42-n79 but has not the ability to be configured with simultaneous RX/TX.  NTT DOCOMO, INC:  We would like to clarify whether or not there are existing Rel-15 UE supporting simultaneous Rx/Tx based on the current TS 38.101-3, i.e., without MSD.  If such UE(s) exist, then we don’t think we need to introduce any MSD.  If such UE(s) do not exist and it is difficult to implement UE supporting Rx/Tx without MSD, we may need to introduce the same MSD values with n78-n79 case in both Rel-15 and Rel-16.  This was our understanding. Would this work?  Qualcomm: Rel 15 UE cannot handle simultaneous RX/TX without special implementation for dedicated filtering in B42 path.  NTT DOCOMO, INC:  Thank you for your reply, With this clarification, is it OK to introduce MSD from Rel-15? More specifically,    Add a Note to DC\_42\_n79 saying that simultaneous Tx/Rx is not supported when implementation uses a n77 filter (Same note with n78-n79)    Add MSD due to cross-band isolation for B42 and n78 based on CA\_n78-n79 numbers for the relevant CH BW and UL allocations.    Add a Note to delta\_TIB for DC\_42\_n79(same numbers with n78-n79).    Higher delta\_TIB can be apply for n79 only with 4400-4500MHz.    Note: Higher delta\_TIB is not applied for B42 since it can be applied for n78 only with 3700-3800MHz  Skyworks: We are OK with your last suggestion but I’ll be waiting for others feedback and work with you to revise the CR according to consensus. And then I will also draft the R16 CR, but do you mean to have the same as R15 CR?  Huawei: For DC\_42\_n79, it’s not a good idea to introduce the simultaneous RX/TX in Rel-15 spec at the end of Rel-16. Maybe Rel-15 UE have entered into the market. We need more time to check it.  Qualcomm: Qualcomm needs more time to check this as well. It was a simple “note” change, and now it has grown complex 1-2 days before meeting deadline.  Skyworks: At this point of the meeting the simplest is to leave our release 15 CR as is and then bring R16 with simultaneous TX/Rx and MSD at the next meeting  Moderator: By reading your last mail Dominique, I think you still want to try to get the original CR agreed in R15?  Yuta, can you check the original R4-2011460 again to see if you are OK?  If yes we will agree on that one and ask for a mirrorCR for R16 to implement the mirror contents.  If not the proponent needs to come back in the next meeting. The CR is postponed.  Qualcomm: Option 1 with no other modification.  NTT DOCOMO: We are sorry, but we would like to continue to discuss this in next meeting.  We would like to keep the spec as it is so far, which means that simultaneous Rx/Tx for B42\_n79 may be supported without MSD. Note that the function is optional feature distinguished by simultaneous Rx/Tx UE capability.  This is our understanding on the current spec, and so we don’t want to exclude the possibility of simultaneous Rx/Tx for Rel-15 UE.  Skyworks: As we have discussed, this is not OK with us as simultaneous Rx/Tx UE is not feasible for all implementations. We at least need something that says “simultaneous Tx/Rx cannot be supported with implementations supporting B42 with n78 or n77 filter” current R15 spec say nothing and can be interpreted in many different ways and otherwise is incomplete without MSD. We can then discuss how to best handle R16 in next meeting. |
| Others: |  |

## Summary on 2nd round

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| R4-2010825  R4-2010826 | Postponed;  ACR withdrawn |
| R4-2011460 | Postponed |